SECRET

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DOES NOT APPLY

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TO FOREIGN
NATIONALS

61 2935

9

# NATIONAL SPACE PROGRAM



JUNE 3, 1961

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# CONTENTS

INTRODUCTION

## INTRODUCTION

This document summarizes the various projects which comprise the National Space Program. The characteristics, performance, schedules, funding and other pertinent information are included for ready reference. The schedule projections are best estimates and cannot be considered firm because they are based upon extrapolations of the state-of-the-art and also assume certain funding levels beyond the approved funding through FY 1961 and the revised funding proposed for FY 1962. An over-all funding summary is presented in Section II. This document has been jointly prepared by NASA and DOD staffs.

NATIONAL GOALS

## NATIONAL GOALS

In accordance with the principle stated by the President of the United States in his message to Congress on May 25, 1961, it is the intent of the United States "to take a clearly leading role in space achievement."

Broad substantive objectives such as pursuit of knowledge, international cooperation, and technological development are included within the over-all space program. The immediate primary goals dictating the orientation of the program are as follows:

PRACTICABLE

1. Earliest possible achievement of manned lunar exploration.
2. Early world-wide operational satellite communication capability.
3. Early world-wide satellite weather prediction capability.
4. Aggressive scientific investigation program
   a. Achieve better understanding of the sun and its influence on the earth
   b. Investigate the solar system, its nature and history
   c. Search for life in space
   d. Study cosmology, history and nature of the universe.
5. Support an adequate booster program capable of meeting both civilian and military needs.

Projects in space may be undertaken for any one of four principal reasons: (1) Scientific, (2) Commercial, (3) Military and (4) National Prestige. It is the intent of the United States to conduct a high priority program of space exploration and utilization which will provide major benefits for scientific, commercial or military interests and which will contribute significantly to increasing the national prestige.

# MERCURY-Project

FIRST MANNED ORBITAL FLIGHT

NASA

MILESTONES

5. FIRST MANNED REDSTONE FLIGHT
4. FIRST REDSTONE FLIGHT
3. MACH ABORT
2. FIRST ATLAS FLIGHT
1. LITTLE JOE ABORT FLIGHT

PLANNED FIGURES

| FY | 48.8 | 59.1 | 134.5 | 74.2 | ---- | ---- | ---- | ---- | ---- | ---- | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CY | PRIOR | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | TOTAL | |

EVENTS

Mer. O Abort test

First orbital flight attempt (Failure)

Mer. O Abort test

Atlas entry test

First orbital ballistic flight

Mer. O Abort (Failure)

Atlas entry test (Failure)

BASIC FACTS

1. Objective: To orbit a man about the earth and bring him back safely. To investigate man's capabilities in space environment.
2. 17 ground stations.
3. 23 spacecraft in program.
4. Little Joe solid booster for abort tests.
5. Redstone for Ballistic Flight test.
6. Atlas booster for entry tests and orbital flights.

To date: Successful manned ballistic flight.

CLASSIFICATION CHANGED
To UNCLASSIFIED
By authority of NASA Memo 10-28-63
Changed by [illegible]

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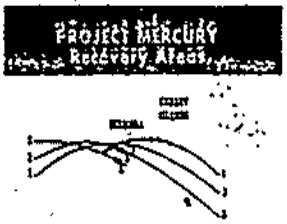
CONFIDENTIAL

APOGEE 120 MI
PERIGEE 85 MI
INCLINATION 32°





OPERATIONAL SCHEME

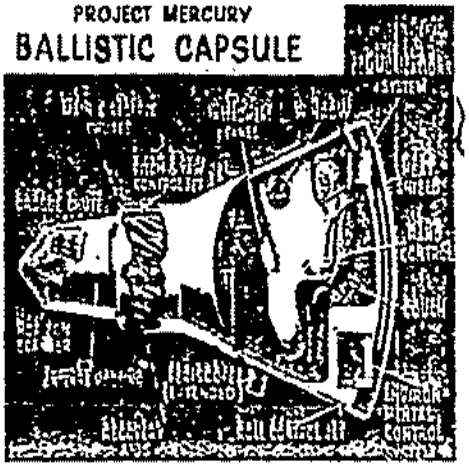


# MERCURY

## NASA

PROJECT MERCURY

## BALLISTIC CAPSULE



MERCURY CAPSULE CUTAWAY

SPACECRAFT
Height 10'
Base Diameter 6'
Weight 2,800 lbs.
Stabilization & Control System
3 Automatic Hydrogen Peroxide
Short propulsion for launch phase
Some propulsion for orbit descent
Environmental control system 3.5
pure oxygen

GROUND SYSTEM
17 Ground stations for communication &
tracking, data acquisition
2 Computing centers
Launch site-AMR

DATA
Heart & respiration & other astronautical data
Environment
Spacecraft system data
Events

CONFIDENTIAL

# APOLLO

NASA

A spacecraft (now in study stage) capable of carrying three men for 14 days on the following missions:

a. Earth orbit
b. Circumlunar flight
c. Moon orbit

It is planned to have the Apollo ready for the manned lunar landing mission.

The weight of the Apollo spacecraft is estimated to be between 15-30,000 lb., launched from AMR by a Saturn type vehicle with landing at Edwards Air Force Base. The entire spacecraft design, its shape and weight, depends to a great extent on two important unknowns:

a. Man's toleration of weightlessness. If his tolerance level is low in terms of time, then some form of artificial gravity or perhaps other forms of sensory stimulation will have to be used.

b. The amount of shielding required to protect men in space flight. In this area, a clear definition of the pertinent types of radiation, and their effects on living beings, is needed.

The Apollo spacecraft will consist of three modules as follows:

a. Command and re-entry module
b. Service module
c. Propulsion module

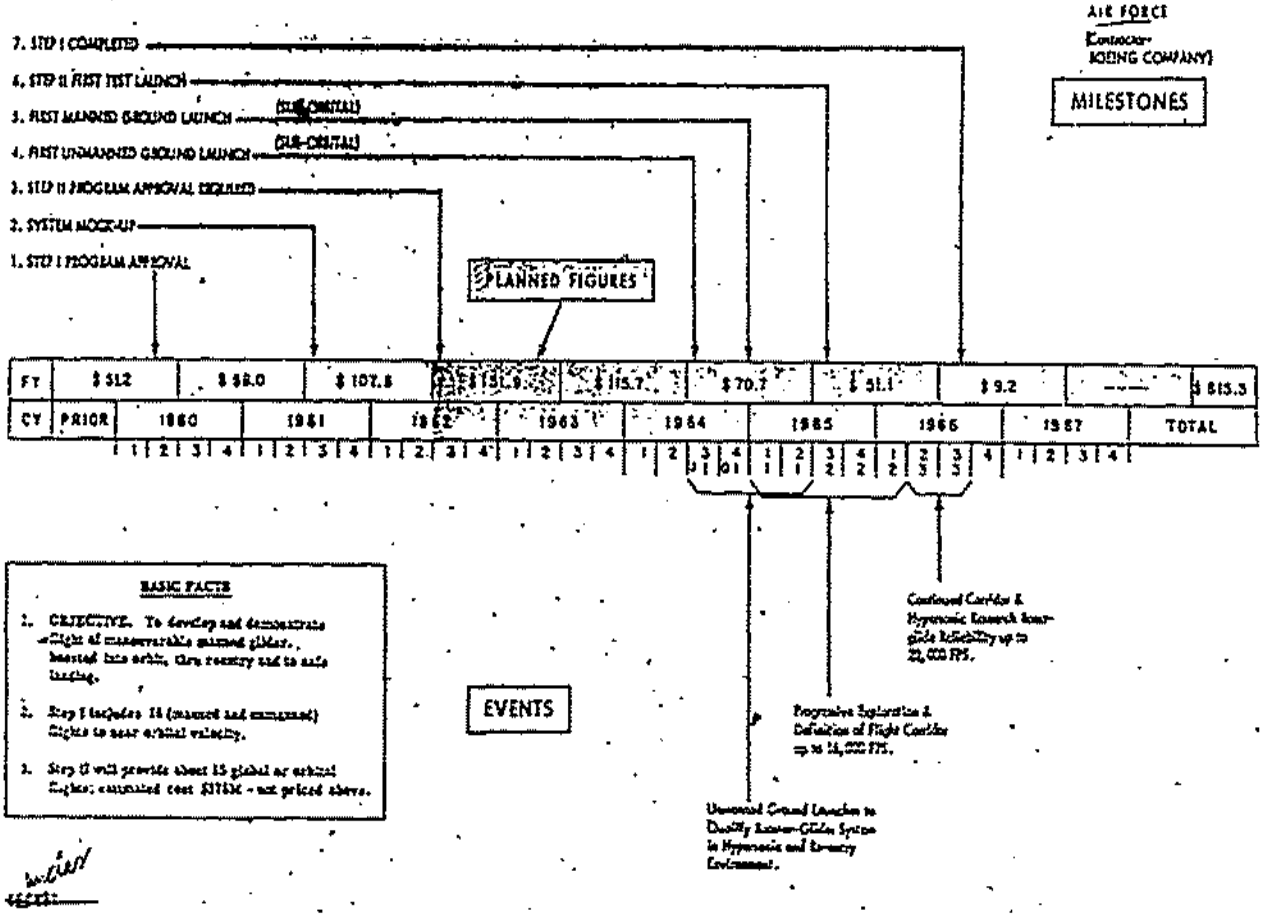
In addition to these basic modules, an escape or abort system is also incorporated.

At present, the following schedule has been established for the contracting phase of Apollo:

a. Apollo conference - July 28 to 30
b. Ribbon cut-papers - August 1
c. Target date for award of contract - January 1962

Manned lunar landing was scheduled for the post 1970 period in the NASA Long Range Plan of January 1961. In accordance with the President's Message to Congress on May 25, 1961, the entire Apollo program is being studied intensively and could be completely revised, depending on Congressional action. This revision would consist of completely revamping the program to accomplish the manned lunar landing and return in the 1967 to 1970 time period.

# DYNA SOAR




**BASIC FACTS**

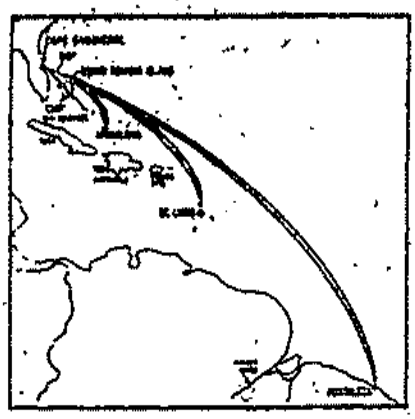
1. OBJECTIVE. To develop and demonstrate flight of maneuverable manned gliders, boosted into orbit, then reentry and to safe landing.
2. Step I includes 14 (manned and unmanned) flights to near orbital velocity.
3. Step II will provide about 15 global or orbital flights; estimated cost $[illegible] - not priced above.



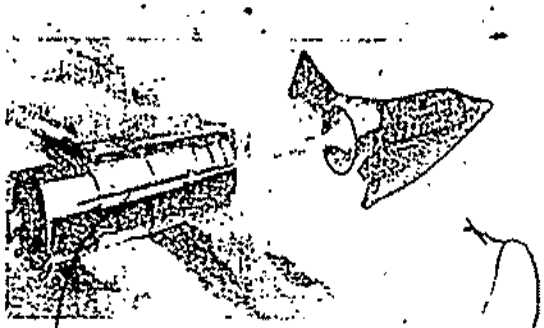
AF-2

# DYNA SOAR - AIR FORCE

(Contractor-
BOEING COMPANY)



STEP I LANDING SITES



SECOND STAGE--GLIDER SEPARATION

The Dyna Soar program will demonstrate the capability for positive, pilot-controlled re-entry and recovery from orbital flight. The pilot of a lifting re-entry glider will have the ability to control his return to earth by extending the flight path by several thousand miles straight ahead or to the side followed by a conventional landing. This will permit the pilot to select the time when he will initiate re-entry and to control the point where he will land.

Step I is approved for implementation and will include hypersonic research and demonstration of the glider up to speeds of 22,000 feet per second by flights on the Atlantic Missile Range. Booster will be a modified TITAN II ICBM. Step II is approved for planning only and will require a larger booster. The research and demonstration program will be extended to orbits at 75 to 100 miles altitude and about 25,500 feet per second. Step III is approved only for study of the possible weapon system uses of the technology developed in Steps I and II.

# UNMANNED SPACE EXPLORATION

# Military Uses of Space: 1946-1991

**Published by:**
Chadwyck-Healey Inc., 1101 King Street, Alexandria, Virginia 22314

Military Uses of Space: 1946-1991 provides a detailed record of the strategic importance of the U.S. military space program from the conceptualization of the uses of space to the present realization of advanced capabilities. Materials were identified, obtained, assembled, and indexed by the National Security Archive, a non-profit, Washington, D.C. based research institute and library. The microfiche collection is accompanied by Military Uses of Space: 1946-1991 Guide and Index.

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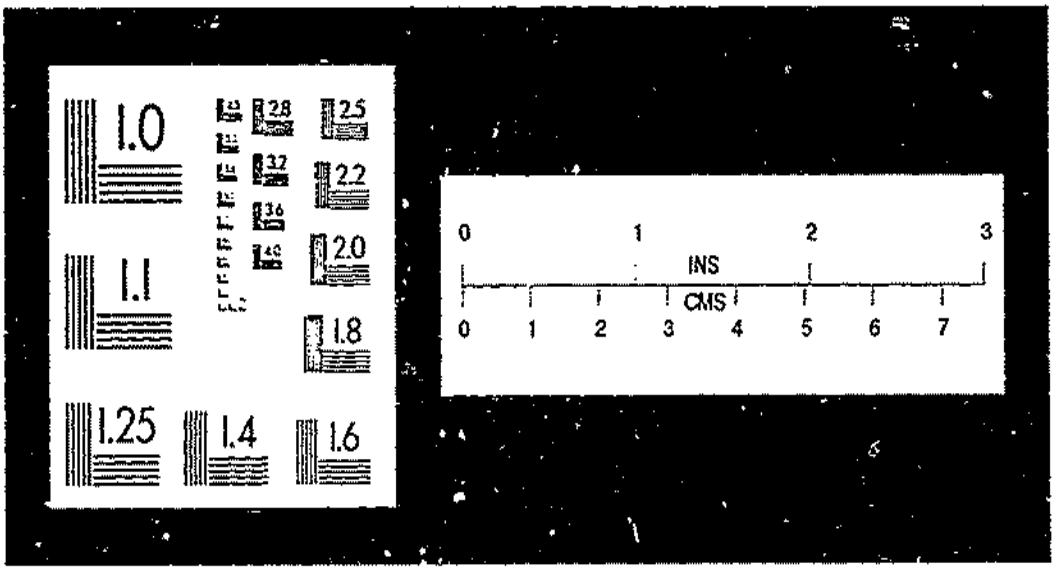

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# RANGER-Lunar Probes

NASA

MILESTONES

PLANNED FIGURES

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 19.5 | 40.2 | 50.8 | ——— | ——— | ——— | ——— | ——— | ——— | ——— |
| PRIOR | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | TOTAL | |

DESIGN & SYSTEM TEST

OPERATIONS

EVENTS

SUBJECTS

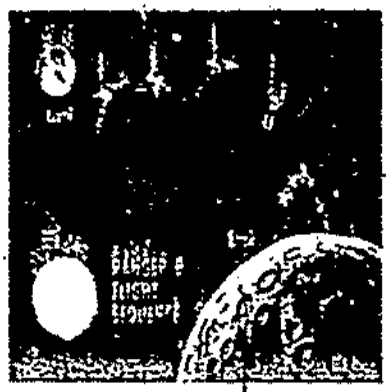
1. Objectives: Developm[illegible] spacecraft technology.
   a. Attitude control system
   b. Steerable high gain antenna
   c. Mid-course maneuver
   d. Landing retrievable payload on moon.
2. Scientific measurements
   a. Energetic particles and magnetic fields in space.
   b. Seismic measurements on lunar surface.
   c. TV pictures of lunar surface.
   d. X-ray [illegible] copy of lunar surface.
3. Status: [illegible] first launch in 1961.

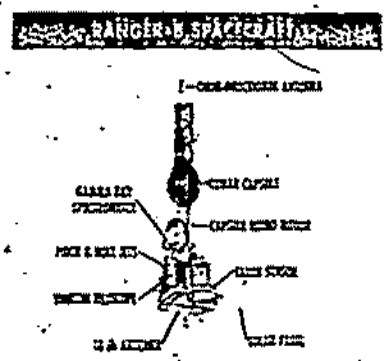
# RANGER

## LUNAR SPACECRAFT

### NASA

PRIME CONTRACTOR: JET PROPULSION LABORATORY






**SPACE CRAFT**

Weight: 730 pounds
Trajectory: Lunar impact
Power Source: Solar cell panels
Attitude Control: Gas jets for
sun & position
Propulsion: ATLAS - AGENA B with
solid rocks for capsule
Communications: Transmitter 0.25 W.
Transponder 2W
Instruments: Vidicon, γ Ray Spectrometer, Seismometer

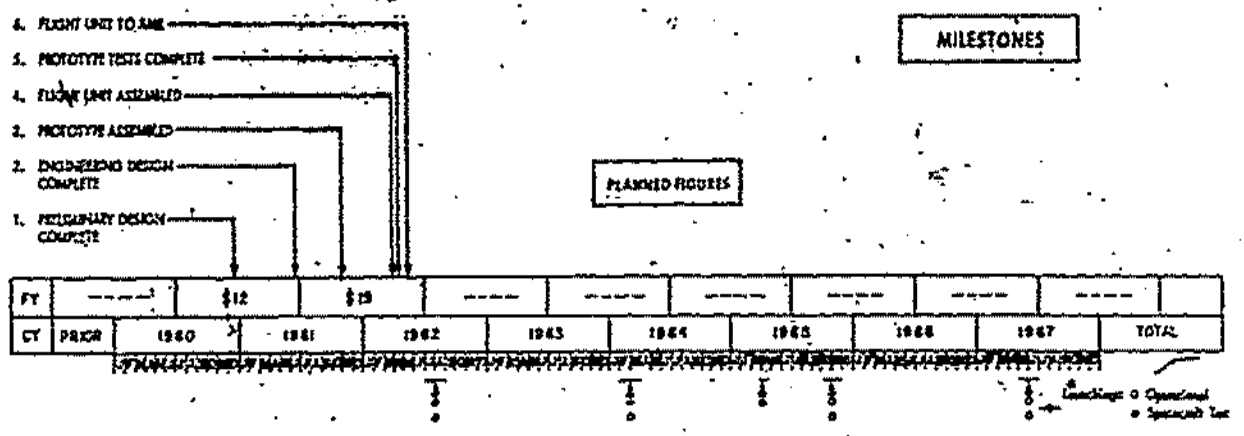
**GUIDANCE SYSTEM**

Deep space instrumentation
facility - tracking & command
IBM 7090 computer
At JPL for evaluation
and midcourse computation
AMR ground range stations
for pre-injection tracking

**DATA**

Lunar Radio-activity
Lunar Body Properties

# MARINER A-Venus Fly-by




EVENTS

**BASIC FACTS**

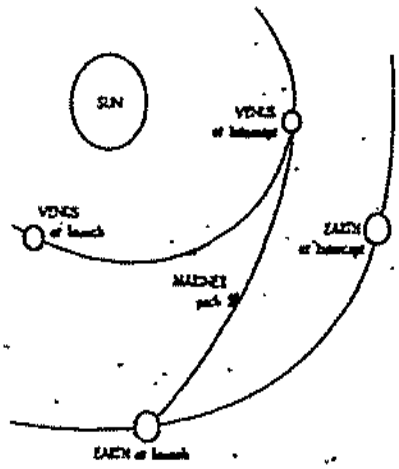
1. Objectives: To make meaningful scientific measurements at Venus and in interplanetary space. To develop automatic, unmanned, interplanetary spacecraft technology.
2. 3 spacecraft test flights – 2 toward Venus, 1 interplanetary.
3. 4 operational flights.
4. Contract used for entire program.
5. Program phases into Venus orbiter (Voyager) in 1966-7

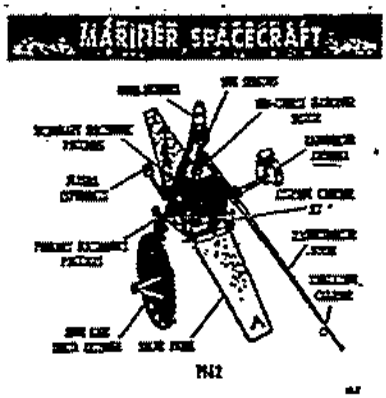
# MARINER A

## VENUS FLY-BY SPACECRAFT

### NASA

PRIME CONTRACTOR: JPL




**SPACECRAFT**

Weight: [illegible] pounds
Trajectory: Venus FLY-BY
Power: Solar Cell Panels
Attitude control: Gas jets
Propulsion System: ATLAS CENTAUR
Communications: Digital phase coherent telemetry, pseudo random coded ranging
Instrumentation: U.V. spectro photometer, cosmic dust sensors, magnetometer, micrometer, radiation detectors.

**GROUND SYSTEM**

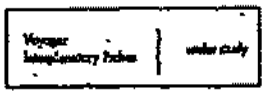
Deep space instrumentation facility
IBM 7090 computer for evaluation and command computation
AMR down range station for pre-injection tracking

**DATA**

Composition of atmosphere of Venus
Cosmic dust composition & trajectories
Temperature profile of Venus
Field & Particle environment from Earth to Venus

# PLANETARY EXPLORATION

NASA



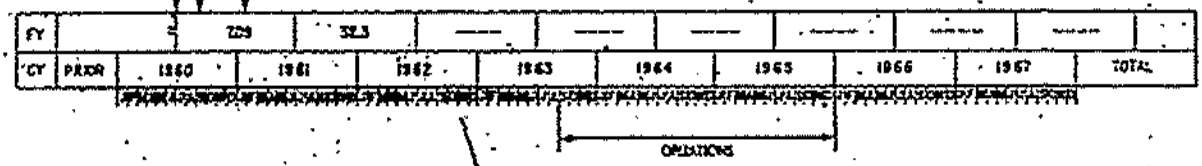
# SURVEYOR-Lunar Soft Landing Spacecraft

NASA

MILESTONES

3. DEV. CONTRACTOR SELECTED
2. DESIGN STUDY CONTRACTS
1. DESIGN STUDY PROPOSALS

PLANNED FIGURES




OPERATIONS

EVENTS

BASIC FACTS

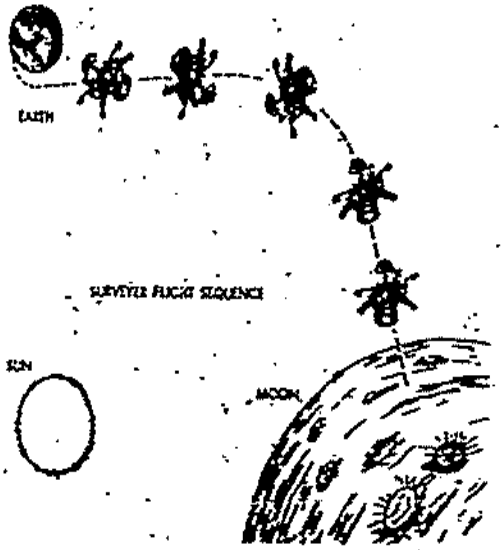
1. Objectives:
   a. Development of lunar soft landing technology.
   b. Visual reconnaissance of lunar surface topography.
   c. Geophysical exploration of lunar surface and sub-surface.
2. Launch Vehicle - Saturn.

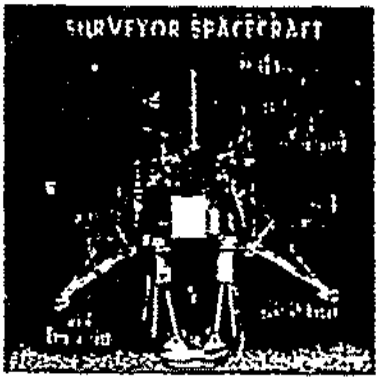
# SURVEYOR

## SOFT LANDING LUNAR SPACECRAFT

### NASA

PRIME CONTRACTOR: HUGHES AIRCRAFT




**SPACECRAFT**

Weight: 2500 pounds
Trajectory: Lunar landing
Power Sources: Solar cell panels
Attitude Controls: Gas jets for axis & position
Propulsion: Liquid Midcourse & Vernier
Solid State Retro
Communications: Telemeter Transmitter
Instruments: TV & Scientific complex

**GUIDANCE SYSTEM**

Deep space instrumentation
Facility with plane-element
& magnetic tape tracking T.M. receivers.
IBM 7090 computer at JPL
For flight evaluation
& command computation
AMR down range stations
For pre-injection tracking

**DATA**

Lunar surface topography
Radiation environment
Surface & Subsurface physical properties
Chemical composition
Meteorology

COMMUNICATIONS
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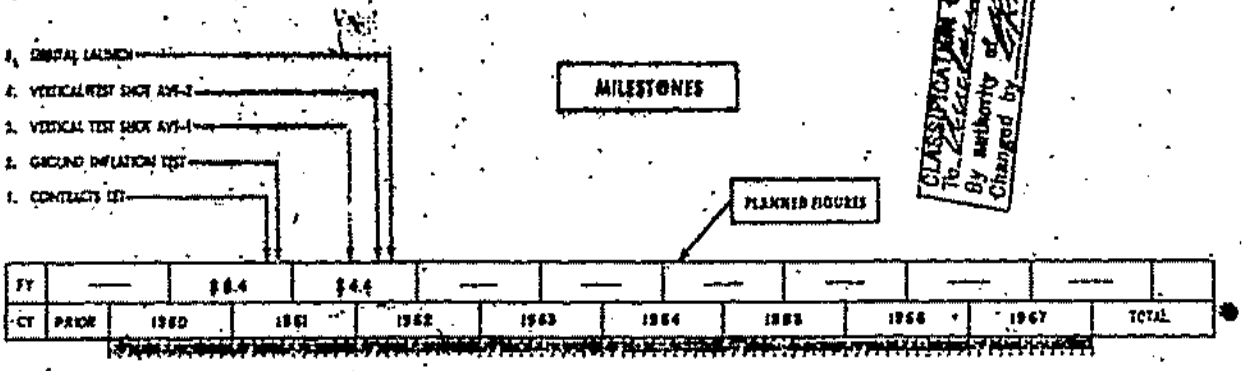
# COMMUNICATION SATELLITES
## PASSIVE
## ECHO II (A12)






EVENTS

BASIC FACTS

1. Objectives: To develop a reflective inflatable sphere capable of retaining its shape in the space environment; to measure the reflecting properties of its surface and its suitability as a passive communications satellite.
2. Two suborbital tests with Thor vehicles to test ejection and inflation techniques.
3. One orbital test with Thor Agena B.

Note: Budget figures include vehicle [illegible]

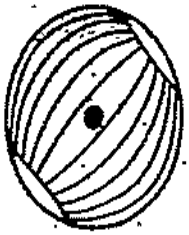
# COMMUNICATION SATELLITES

## PASSIVE - ECHO II

### RIGIDIZED 135' INFLATABLE SPHERICAL PASSIVE COMMUNICATIONS SATELLITE

NASA

CONTRACTORS: G.T. SCHJELDAHL CO.
GRUMMAN AIRCRAFT CO.



LAUNCH

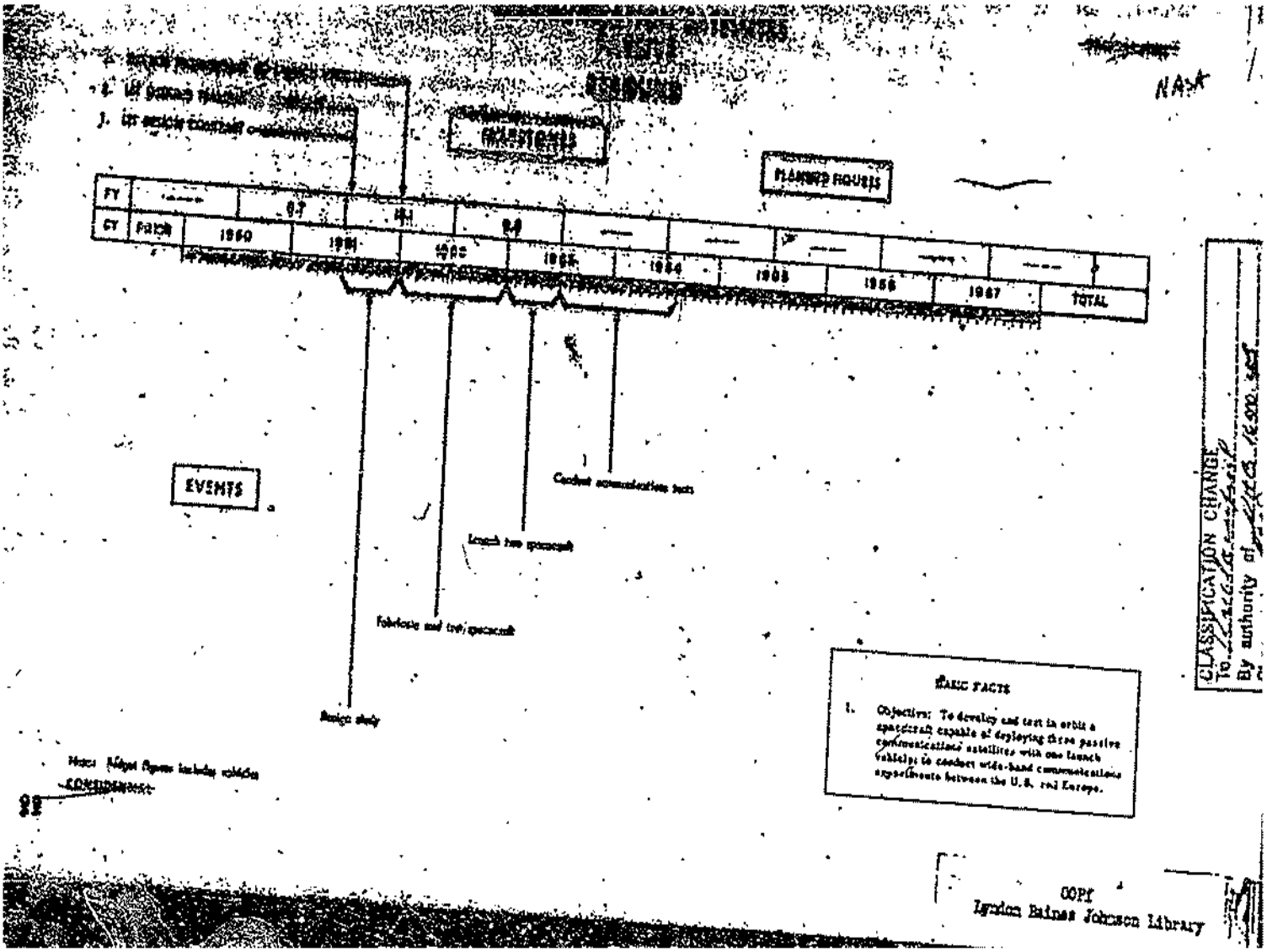
Weight of spacecraft: 700 pounds
Weight of sphere: 260 pounds
Size of sphere: 135' diameter
Materials: Laminate of 0.0025" Mylar between two layers of 0.0002" aluminum foil
Inflating Agent: 30 pounds octafluoride
Orbit: 82° inclination to equator, 1,000 n. mi. altitude
Instrumentation: 136 Mc tracking beacons with solar cell and battery power supply
Launch Vehicle: Thor Agena

GROUND SYSTEM

NASA satellite tracking network
Various sites

DATA

Solar reflective properties of sphere
Solar radiation pressure effects
Air density measurements


NASA
MILESTONES
PLANNED FIGURES
FY
CY
FY67
FY68
1960
1961
1962
1963
1964
1965
1966
1967
TOTAL
EVENTS
Conduct communications tests
Launch two spacecraft
Fabricate and test spacecraft
Design study
BASIC FACTS
1. Objective: To develop and test in orbit a spacecraft capable of deploying three passive communications satellites with one launch vehicle; to conduct wide-band communications experiments between the U.S. and Europe.
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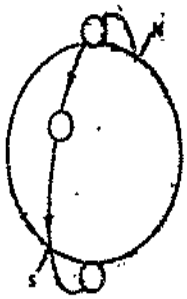
# COMMUNICATION SATELLITES
# PASSIVE-REBOUND

## PASSIVE COMMUNICATIONS SATELLITE
## THREE-SPHERE SPACECRAFT

**NASA**

PRIME CONTRACTORS TO BE SELECTED



SATELLITE

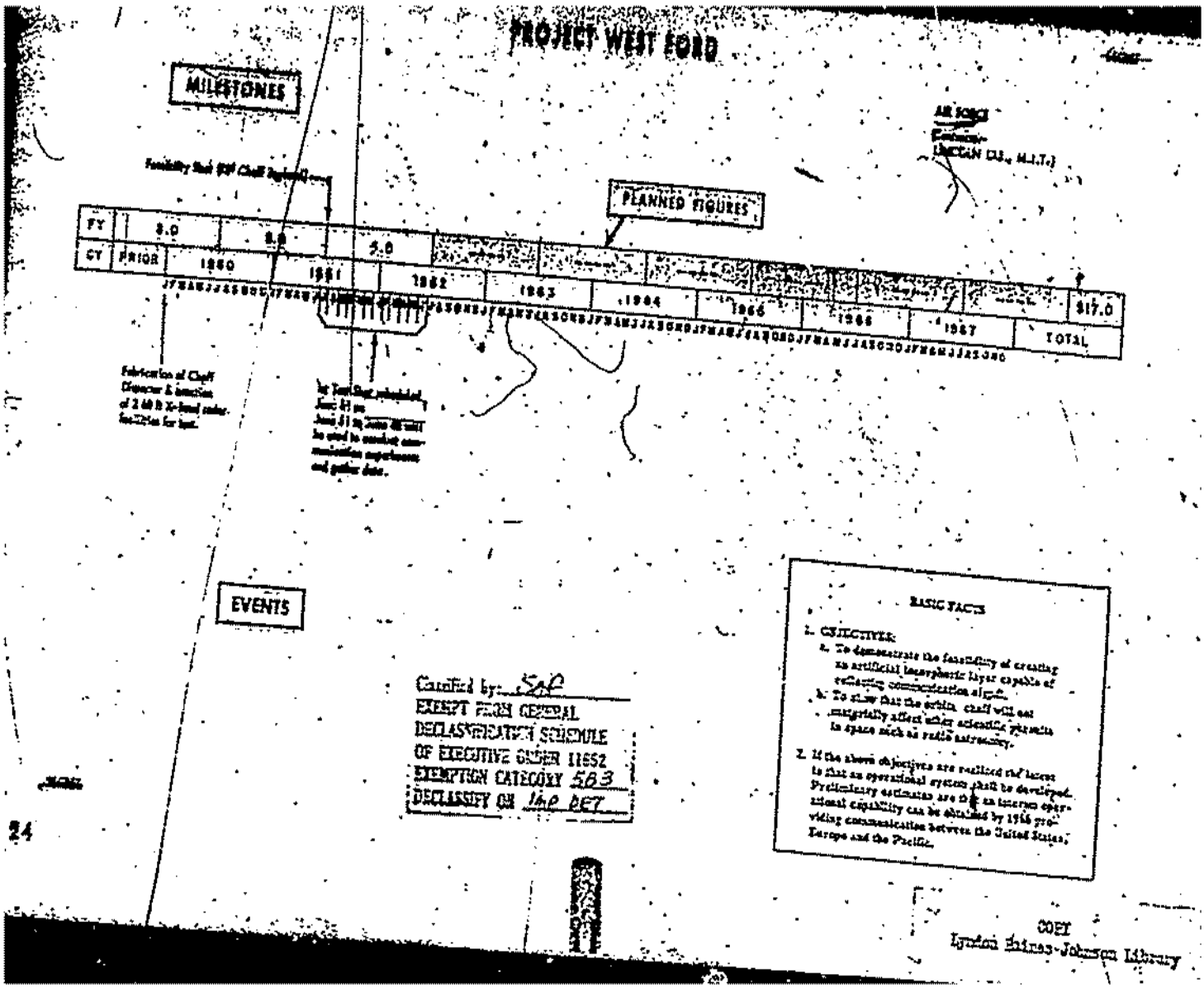
- Weight of each sphere 200 pounds
- Orbit: Near-polar, 1000 n. mi. altitude
- Instrumentation: Two tracking beacons with solar cell and battery power supply
- Launch vehicle: Atlas Agena

GROUND SYSTEM

- Terminals in U.S. and Europe
- High-powered transmitters and low-noise receivers with wide band capability
- NASA satellite tracking network

DATA

- Transmission of wideband communications signals (TV, multichannel voice)


PROJECT WEST FORD
MILESTONES
PLANNED FIGURES
EVENTS
FY
CY
PRIOR
1960
1961
1962
1963
1964
1965
1966
1967
TOTAL
$17.0
BASIC FACTS
1. OBJECTIVES:
a. To demonstrate the feasibility of creating an artificial ionospheric layer capable of reflecting communication signals.
b. To show that the orbits [illegible] will not materially affect other scientific pursuits in space such as radio astronomy.
2. If the above objectives are realized the intent is that an operational system shall be developed. Preliminary estimates are that an interim operational capability can be obtained by 1966 providing communication between the United States, Europe and the Pacific.
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DECLASSIFICATION SCHEDULE
OF EXECUTIVE ORDER 11652
EXEMPTION CATEGORY 5B3
DECLASSIFY ON: 140 DET
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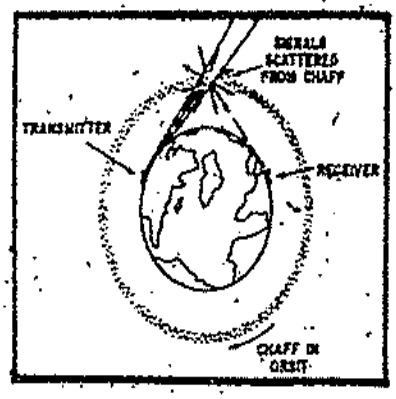
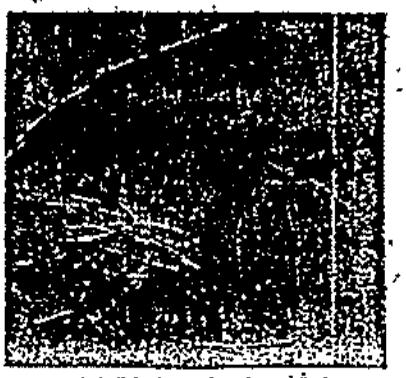
# WEST FORD AIR FORCE

(Contractor-
LINCOLN LAB.,
M.I.T.)




Long-range scatter communications by means of chaff in orbit about the earth. X-band approximately 8000 mc with 100 kw power and 80° K receivers.



Typical chaff dipoles, with sewing needle for size comparison.

General Description

Project WEST FORD is the code name assigned to a passive satellite communication experiment utilizing chaff (1/2 wave dipoles) in orbit. As a secondary function of an experimental launching (approximately 15 June 1961) a 100 pound package containing 70 pounds of chaff will be orbited. This amounts to nearly a billion dipoles in a circular belt around the poles of the earth at an altitude of 2,300 miles. The useful life of the belt is estimated to be from 3 to 6 months for gathering experimental data. Although the world turns underneath the belt using a point at or near the poles as the reflector available full time and little or no tracking should be required by the transmitting and receiving antennas. In the experiment X-band (approximately 8000 mc) transmitting and receiving antennas will be located near Boston and San Francisco. Sixty-foot-diameter antennas have been built at these locations. The experimental power will be approximately 10 kilowatts. This arrangement is expected to provide an information capacity of approximately 50,000 bits per second.

Next Key Decision

Several radio astronomers have published papers indicating that an orbital chaff system will interfere with radio astronomy. This has resulted in WEST Ford being limited to the initial feasibility shot until such time as the extent of interference has been determined. Providing the experimental results eliminate this problem, the decision should be made as to whether to accelerate this promising technique for military communications. Approximately 6.0 million dollars would be required in FY-62 in order to start the prototype of an operational system. If these funds were made available a limited operational capability could be realized if a 1000 pound payload of chaff were placed in orbit in calendar year 1963.

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DECLASSIFICATION SCHEDULE
OF EXECUTIVE ORDER 11652
EXEMPTION CATEGORY 5B3
DECLASSIFY ON: Indef.

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# RELAY - Active Communications Satellite

| FY | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CY | PRIOR | 1959 | 1961 | PROGRAM AND SCHEDULE UNDER REVIEW | | | | | 1966 | 1967 | TOTAL |

# RELAY

## ACTIVE COMMUNICATIONS SATELLITE

### NASA

PRIME CONTRACTOR: SPACECRAFT - RCA

Operational Advice

Satellite configuration under review

**SATELLITE**

Weight: Less than 500 pounds

Orbit: Elliptical, approx 3000 miles, perigee 900 miles, inclination 28° to the equator.

Instrumentation: One-way repeater, radiation flux and ... damage experiment.

Power Source: Solar cells and battery.

Propulsion: 100-125 lbs. total gal. nitrogen.
125-150 lbs. total gal. nitrogen.
150-175 lbs. total gal. nitrogen.

Launch Vehicle: Delta

**GROUND SYSTEM**

NASA Satellite tracking network

Communication terminals in Eastern U.S., France, England

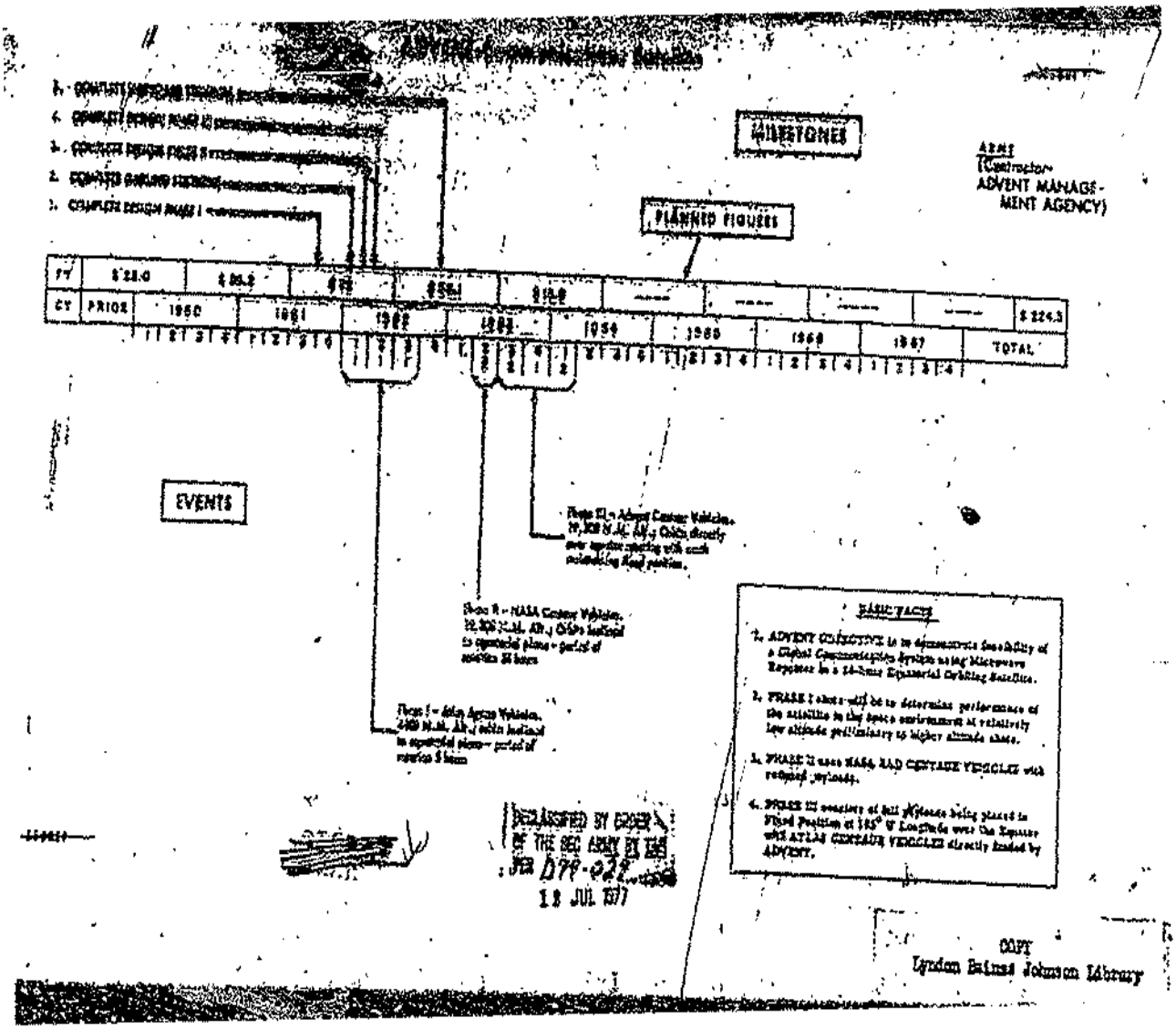
Telemetry control at Goddard station

**DATA**

Wide band communications (TV, eight-channel voice) relayed in either direction

Radiation flux of inner Van Allen belt

Radiation damage to components to be determined


QUESTIONS
ARMY (Contractor- ADVENT MANAGEMENT AGENCY)
PLANNED FIGURES
FY
CY
PRIOR
1960
1961
1962
1963
1964
1965
1966
1967
TOTAL
EVENTS
BASIC FACTS
DECLASSIFIED BY ORDER OF THE SEC ARMY ON 1 JUL 1977
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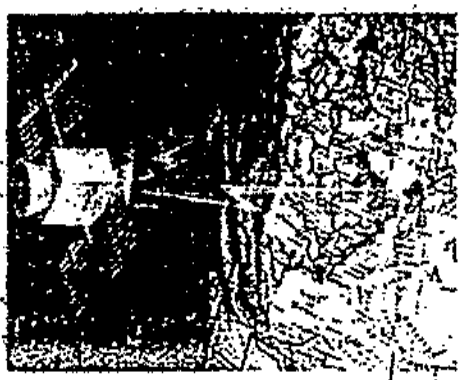
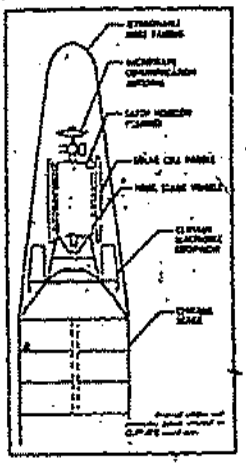
# ADVENT — ARMY

(Contractor-
ADVENT MANAGEMENT AGENCY)





The primary ADVENT objective is to demonstrate the feasibility of achieving a military system for secure microwave communications (surface-to-surface) employing satellite repeaters in 24-hour synchronous equatorial orbit. The feasibility of placing a satellite in predetermined position in a 19,300 mile equatorial orbit must be demonstrated. The feasibility of being able to stabilize the satellite, control its attitude and orbit, and keep it on station within the required tolerances must also be demonstrated. The satellite must be capable of providing worldwide communications on a real time basis at microwave frequencies with a wide bandwidth capacity.

The ADVENT communications payload is engineered to use a launch vehicle configuration which consists of an ATLAS missile as the first stage and the CENTAUR vehicle as the second orbiting stage. The final configuration payload weight will be approximately 1,000 pounds. The total weight of the CENTAUR vehicle including payload and propellants is approximately 36,000 pounds.



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METEOROLOGY

# TIROS Experimental Meteorological Satellite Project

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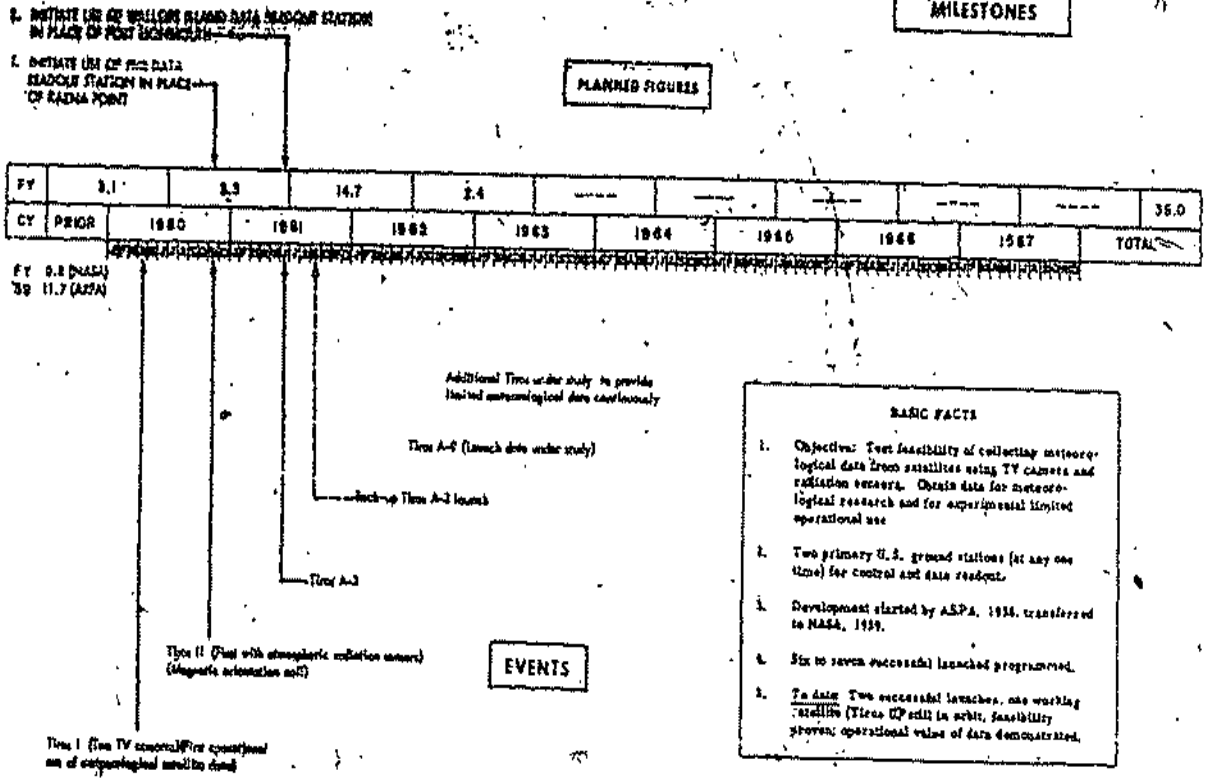



BASIC FACTS

1. Objectives: Test feasibility of collecting meteorological data from satellites using TV cameras and radiation sensors. Obtain data for meteorological research and for experimental limited operational use
2. Two primary U.S. ground stations (at any one time) for control and data readout.
3. Development started by ARPA, 1958, transferred to NASA, 1959.
4. Six to seven successful launches programmed.
5. To date: Two successful launches, one working satellite (Tiros II) still in orbit, feasibility proven; operational value of data demonstrated.

CLASSIFICATION CHANGED
To Unclassified per E.O. 12958, Sec. 3.5
By authority of [illegible]
Changed by [illegible] Date: 3-5-97

Note: Budget figures are for space craft only. Are subsequently submitted to Congress by FY (2)

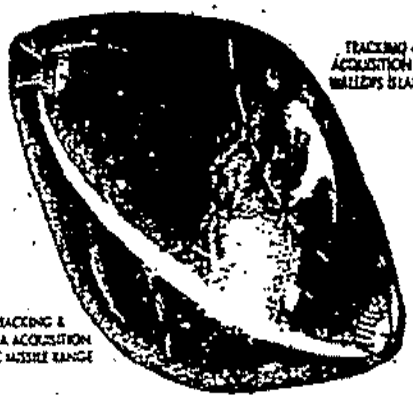
CONFIDENTIAL

# TIROS

## SINGLE SATELLITE METEORLOGICAL OBSERVATION SYSTEM-SPACE ORIENTED

NASA

PRIME CONTRACTOR-RCA, Princeton



TRACKING & DATA ACQUISITION STATION WALLOPS ISLAND, VA.

TRACKING & DATA ACQUISITION PACIFIC MISSILE RANGE


TIROS SATELLITE CUTAWAY

OPERATIONAL SCHEME

SATELLITE

Weight - 200-270 lbs.
Orbit - 400, 450 miles
Instrumentation - 2 TV Cameras
IR Sensing System
5 Channel scanning
2 Channel wide-angle
2 Channel heat-balance
(Not in TIROS I)
Horizon Sensors
Power Source - Solar cells, nickel-cadmium storage batteries
Stabilization Control - Spin-gyro-Wheel
Magnetic orientation coil (Not in TIROS I)
Antenna - Turnstile (TIROS I)
Dish-Cubic
Signals - TV - 235mc, 2 watt, FM (2 transmitters)
IR - 237.3mc, 2 watt, FM
Beacon and telemetry - 108.03mc
108.03mc

GROUND SYSTEM

Tracking - Mechanik
Data Acquisition - Fort Monmouth (TIROS III-V)
Kauai Point (TIROS I)
Fiji (TIROS II and later)
Wallops Island (TIROS A-3 and later)
Nightstown, N.J. (TelCap)
Computer - GSFC, Greenbelt
Data Reduction - GSFC
USWB/MIT
OCD Weather Services and Meteorological Research Agencies
NMC
Launch Site - Atlantic

DATA

Pictures of clouds and cloud patterns
Pictures of sea ice
Radiation - 0.2-5 μ-total reflected from earth and atmosphere
7-30+ μ-total emitted from earth and atmosphere
0.5-0.7 μ-cloud reference
8-12 μ-atmosphere window
6.0-6.5 μ-water vapor band
Responsible Agency - NASA
Prime Contractor - RCA

CLASSIFICATION CHANGED
To: Unclassified
By authority of: NASA Memo dtd 4-20-72
Changed by: [illegible]
Date: 4-23-72

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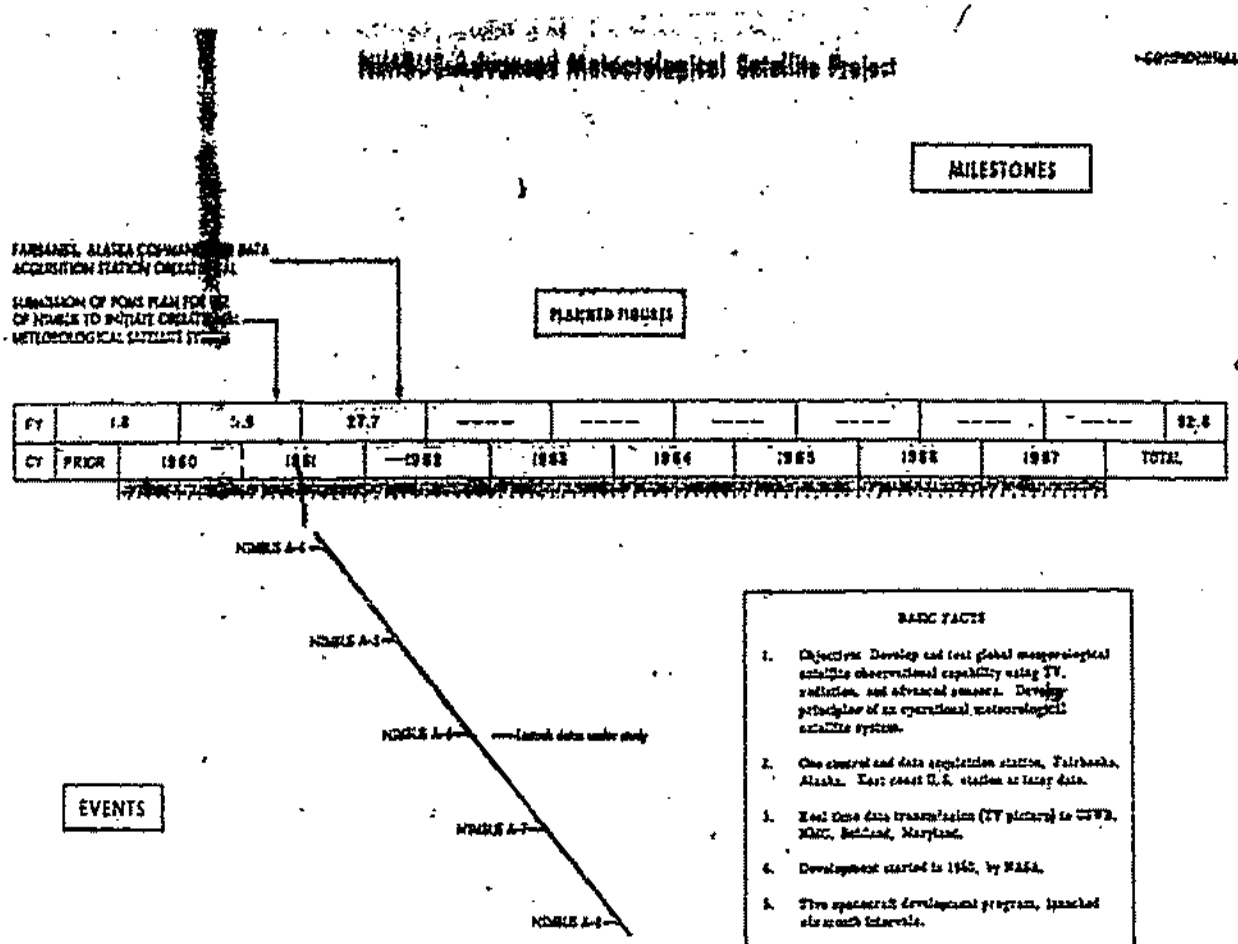

CONFIDENTIAL

# NIMBUS

## CONTINOUS METEOROLOGICAL SATELLITE OBSERVATION SYSTEM-EARTH ORIENTED

NASA

PRINCIPLE CONTRACTORS - GE, ASTRO (integration and test)
GE, ASTRO (Control and stabilization)
RCA, ATF (Power)
RCA, ATF (Medium resolution system)



OPERATIONAL SCHEME -

SATELLITE

Weight - About 400 lbs.
Orbit - 82° inclination, 600 N.M., Circular
Instrumentation and Sensors -
Medium Resolution Infrared radiometer system
High resolution IR (6 μ)
Medium resolution IR (5.5-6.5 μ, 6.5-7.5 μ, 7.5-8.5 μ, 9.5-11.5 μ, 13.5 μ)
Low resolution IR (Atmospheric heat balance)
Low Resolution Beam plus, Solar constant (in development)
Electrostatic tape recorder)
Spectrometer
Image dissector camera(s)
Possibly weather radar
Power source - Solar cells, nickel-cadmium storage batteries
Stabilization and control - Earth oriented by 3-axis Gyros and gas jets (controlled by horizon sensors and integrator)
Propulsion system - Gas-Nitrogen
Signals - TV cameras and IR (Resolution 2), 1500 nm, 3 channels, 5 watt X, Medium Resolution Telemetry; low data very experimental normal 128 mm recorders

DATA

Pictures of clouds and cloud patterns (day & night)
Pictures of sea ice
Indications for earth and atmosphere (reflected & emitted)
Atmospheric heat balance
Solar constant
Lower Winds - Atmospheric Temperatures (thick layers)
Possibly precipitation

GROUND SYSTEM

Tracking - Minitrack
Data Acquisition - Fairbanks, Alaska
Computer - GSFC Spacecom
Data reduction and utilization - GSFC
USWB/ACC and NMC
DOD weather services &
meteorological research agencies
Launch site - PMR

# METEOROLOGICAL SATELLITES

NASA

INSPECTION DEVELOPMENT
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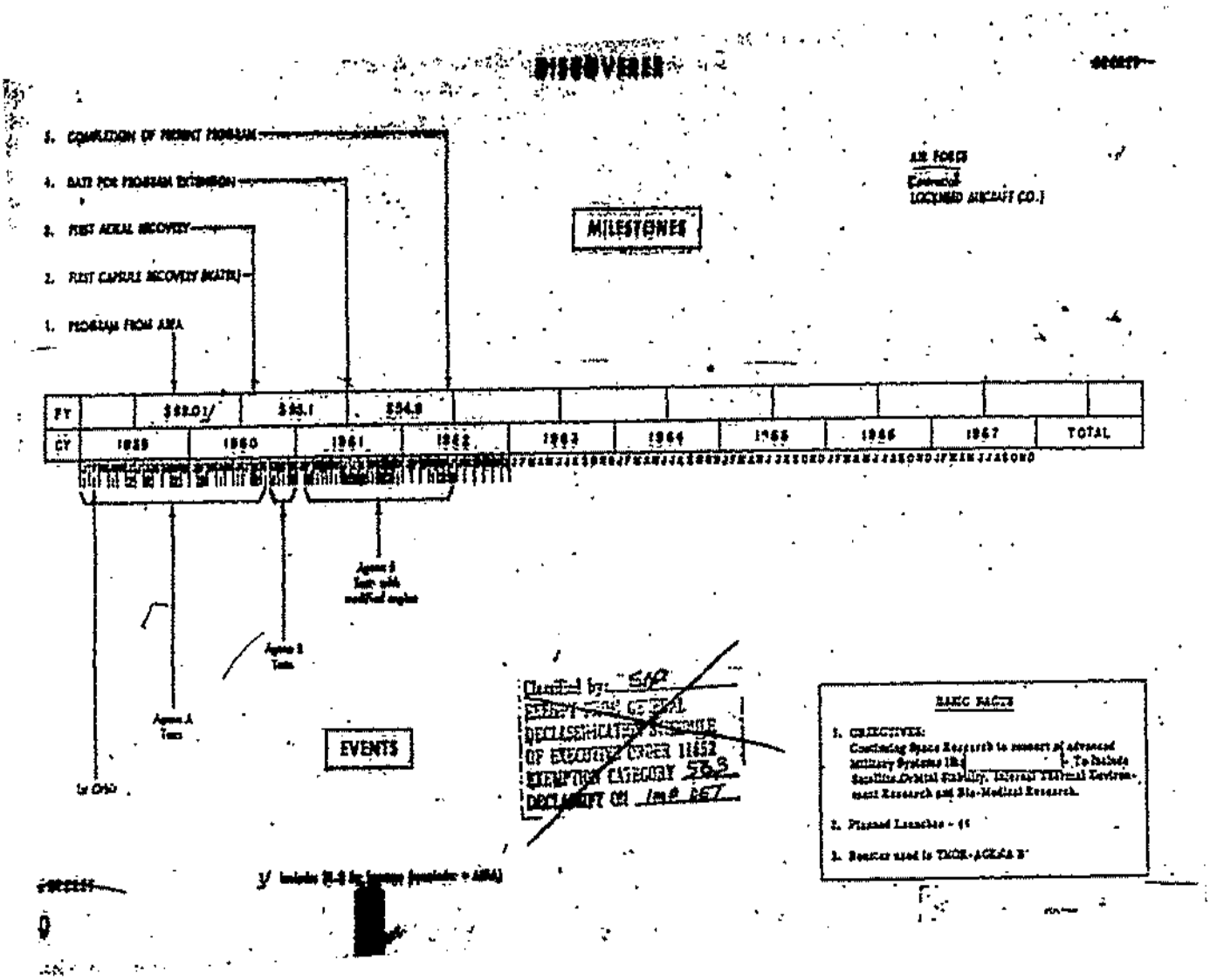
DISCOVERER
5. COMPLETION OF PRESENT PROGRAM
4. DATE FOR PROGRAM EXTENSION
3. FIRST AERIAL RECOVERY
2. FIRST CAPSULE RECOVERY (WATER)
1. PROGRAM FROM AMA
MILESTONES
AIR FORCE
LOCKHEED AIRCRAFT CO.
FY
CY
1959
1960
1961
1962
1963
1964
1965
1966
1967
TOTAL
EVENTS
Classified by: SAP
DECLASSIFICATION OF EXECUTIVE ORDER 11652
EXEMPTION CATEGORY 5B2
BASIC FACTS
1. OBJECTIVES:
2. Planned Launches - 46
3. Booster used is THOR-AGENA B

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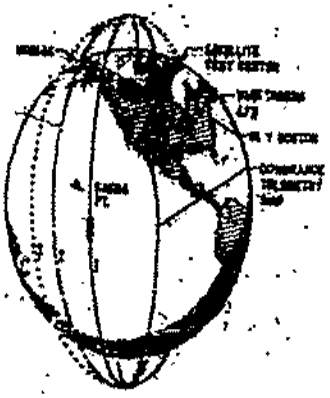
# DISCOVERER AIR FORCE

(Contractor-
LOCKHEED AIRCRAFT CO.)

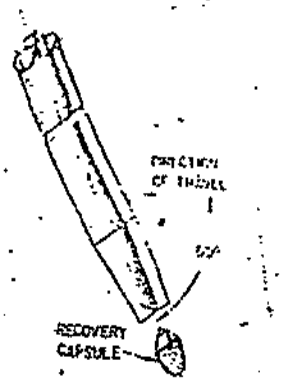


ORBITAL TRAJECTORY

DISCOVERER is launched from Vandenberg AFB under overall control of the Satellite Test Center at Sunnyvale, Cal. Tracking and Telemetry functions are conducted during ascent by Vandenberg and Pacific Missile Range.

RECOVERY

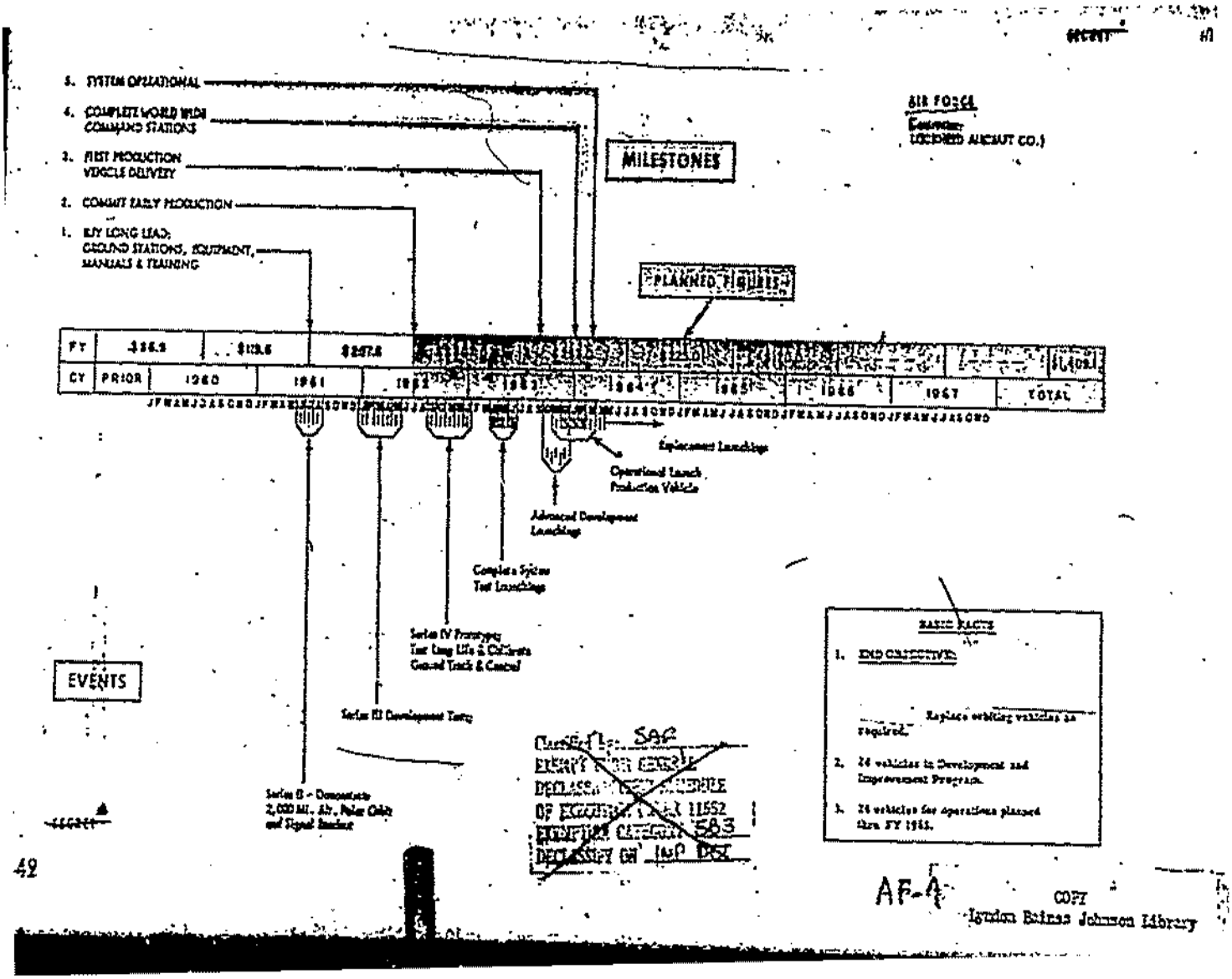
Ejection of capsule is programmed to occur on a selected orbit, for impact within the predetermined recovery area near Hawaii. Recovery aircraft and surface vessels are deployed within this area.




RECOVERY SEQUENCE

The satellite is pitched down 60°, the capsule is separated, spun, retro rocket is fired, capsule is despun and aerodynamically oriented for reentry. A parachute is deployed, radio beacon is activated chaff is ejected. Aircraft hooks in, and snag chute in a sling. Water recovery backup to aircraft.

SECRET




42

AF-4

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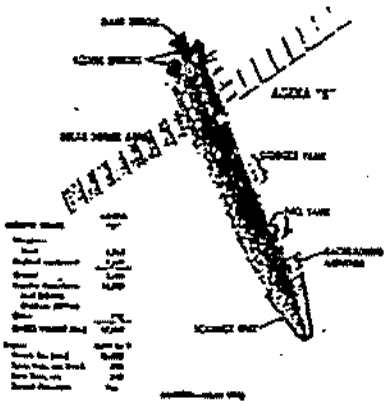
AIR FORCE



The system is designed to provide

The system is designed to accomplish intelligence readout of acquired data by at least one of three strategically located readout stations. The readout stations transmit the data directly to the Tracking and Control Center where it is processed.

payload is engineered to use a standard launch vehicle configuration. This consists of an ATLAS booster as the first stage and the AGENA vehicle, as the second, orbiting stage. The final configuration payload weight will be approximately 1,600 pounds.

Carried by: SAF
[illegible] SCHEDULE
[illegible] 11652
EXEMPTION CATEGORY 5A3
DECLASSIFY ON IMP DET

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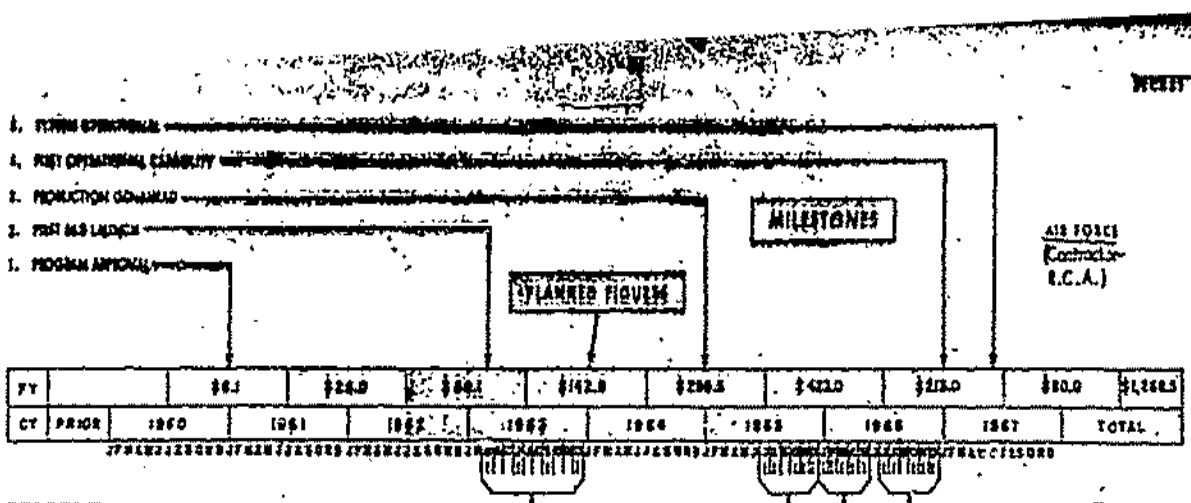
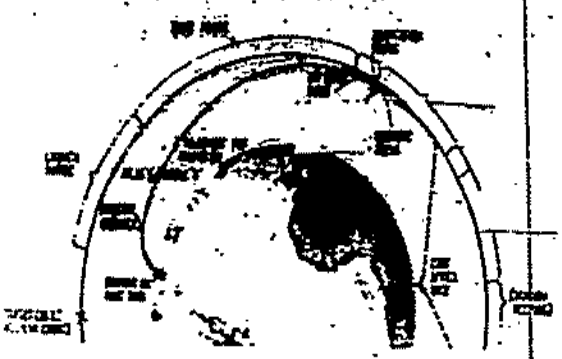
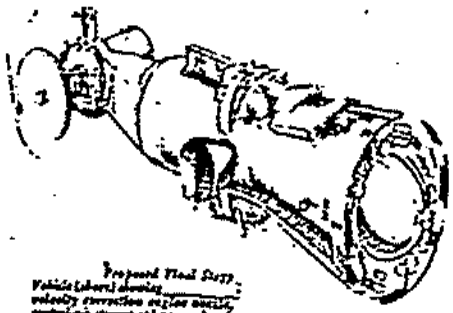


AIR FORCE

(Contractor-
I.C.A.)





Proposed Final Stage
Vehicle (shown) showing velocity correction engine assembly, propellant storage spheres, and attitude control jets.

The _____ system as presently envisioned, consists of three stages including an active "Final Stage" _____. Early configurations of the _____ vehicle will consist of a Series "D" ATLAS booster, AGENA "B" second stage, and a _____ final stage vehicle. This configuration is shown above. Later final stage vehicles having increased _____ capability and additional sensors would be boosted with the ATLAS/CENTAUR. The final stage vehicle will include a _____, launch and _____ guidance system, attitude control, _____ propulsion and a payload. The payload will include a _____ and various other sensors _____. In addition, the payload will have a storage and communications capability.

The demonstration final stage vehicle weighs approximately 2,400 pounds.

AIR FORCE

(Contractor
LOCKHEED AIRCRAFT CO.)

MILESTONES

| FY | 1959 | 1960 | 1961 | 1962 | 1963 | 19 | ,65 | 1966 | 1967 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| QT | | | | | | | | | | |

(Future Schedule & Funds Omitted)

EVENTS

was launched from the Pacific Missile Range Oct. 11, 1960. Both stages fired but orbit was not achieved.

was successfully launched Jan. 31, 1961 into polar orbit from the Pacific Missile Range.

Classified by: SAFF
EXEMPT FROM GENERAL
DECLASSIFICATION SCHEDULE
OF EXECUTIVE ORDER 11652
EXEMPTION CATEGORY 5B3
DECLASSIFY ON Imp Det.

BASIC FACTS

46

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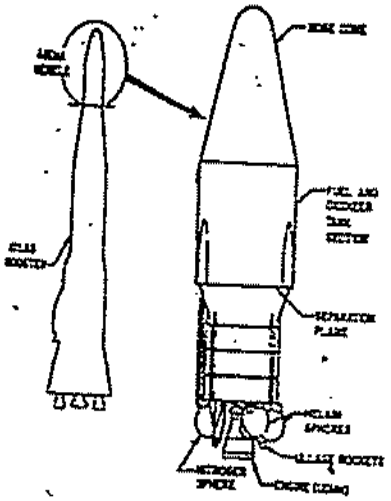
## AIR FORCE

(Contractor-
LOCKHEED AIRCRAFT CO.)


ORBIT SCHEMATIC



VEHICLES

ATLAS–AGENA combination provides capability for orbiting various _____ payloads.

Vehicle is launched from the Pacific Missile Range. Payload is programmed during passage over tracking stations. Information is acquired by satellite and stored until appropriate recovery of information.



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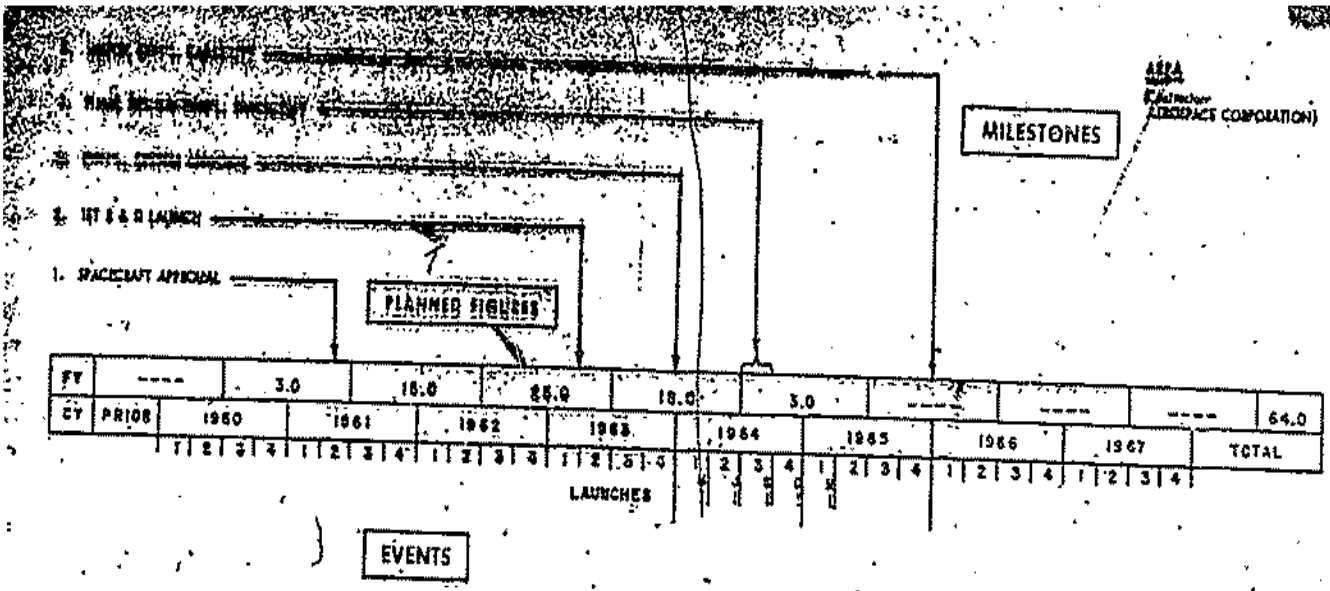



18 MAR 1977

THIS DOCUMENT HAS BEEN DOWNGRADED
TO "UNCLASSIFIED"
Per Director, DARPA 1710

**BASIC FACTS**

1. OBJECTIVE:
To obtain information and experimental data for defining and evaluating the control effectiveness of an operational Far Earth Satellite Detection System which would be established in connection with U.S. policy commitments at Geneva.

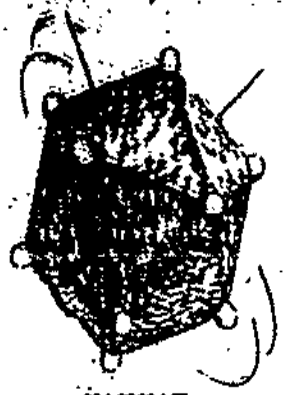
2. Five Atlas-Agena B launches in the R & D effort. Two experimental spacecraft per launch.

3. Treaty draft specifies at least six spacecraft would constitute Far Earth Satellite System. Current conceptual designs indicate that three operational spacecraft can be launched by a single booster.

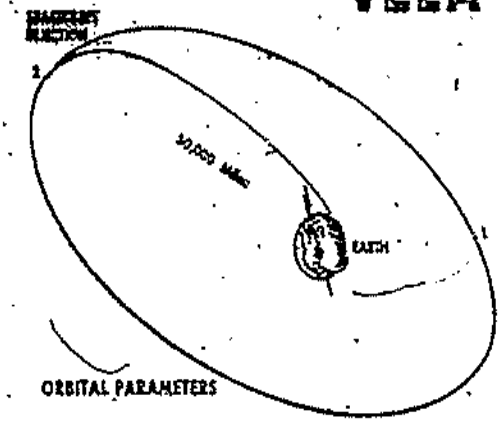
# VELA HOTEL

ARPA

(Contractor - AEROSPACE CORP.)



SPACECRAFT




ORBITAL PARAMETERS

REMARKS (TECHNICAL)

1. The info and data obtained from the early flights will be used for design modifications incorporated in the later flights.
2. Barring unexpected technological pitfalls, it is estimated that enough experimental data will be available after the 1964 flights to define and design an initial operational detection system which meets the Geneva Technical Working Group I performance estimates and to evaluate economic practicability.
3. Background data of interest to VELA HOTEL will be obtained from other spacecraft over the next two years... for example,
   a. S-3 (NASA)
   b. Ranger (NASA)
   c. ARENTS (ARPA)
   d. Piggy-back payloads on six DISCOVERER satellites (ARPA)



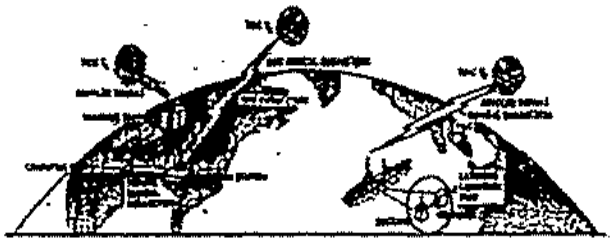
REMARKS (MANAGEMENT)

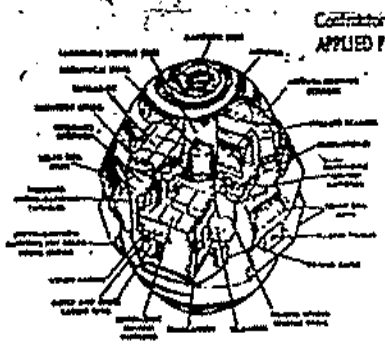
1. DOD (ARPA) has overall responsibility for VELA HOTEL Program.
2. AEC will support DOD by providing the detectors and associated logics.
3. Basic R & D plan was initiated by a Joint Air Force/AEC/NASA Planning Team established by ARPA.
4. Under the supervision of ARPA, program will be implemented by a Joint Air Force/AEC Technical Group chaired by the Air Force Systems Command; close technical liaison will be maintained with NASA.
5. Management coordination with NASA will be maintained by ARPA.

# TRANSIT

## NAVY

Contractor -
APPLIED PHYSICS LAB.,
J.H.U.)





Ground Portion of TRANSIT (A Project)

The TRANSIT navigation system furnishes an accurate determination of position to a ship, submarine, or aircraft equipped with a radio receiver and computer. The system operation is based on the Doppler effect - the change in frequency of a received signal is proportional to the rate of change of distance between the transmitter and receiver. If the orbit of a satellite transmitting a signal of fixed frequency is known accurately, the position of a receiver within radio line-of-sight of the satellite can be found by carefully analyzing the frequency of the received signal correlated with time. The operational TRANSIT navigation system will consist of four satellites in prescribed orbits, a network of five fixed ground receiving stations, a computing center, a data injection station and the user's navigation equipment.

GEODESY

# NAVY TRI-SERVICE GEODETIC SATELLITE SYSTEM

CONFIDENTIAL

NAVY
Contractor-
APPLIED PHYSICS LAB., J.H.U.)

MILESTONES

4. [illegible]
3. DOD APPROVAL OF LONG RANGE PLAN
2. TRI-SERVICE REVIEW AND APPROVAL OF LONG RANGE PLAN
1. *APPROVAL OF $2.5 MILLION BY ASSIST. SEC. NAVY, ARMY & AIR FORCE (R&D) FOR BACK-UP LAUNCH VEHICLE

PLANNED FIGURES

| FY | | [illegible] | $.836 | 15.0 | 10.0 | 5.0 | | | | | 44.338 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CY | PRIOR | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | TOTAL | |

J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D

EVENTS

Series I - Calibration of SECOR - DOPPLER - OPTICAL SYSTEMS, Preliminary Geodesy; Position of Control Points, Distribution of Gravity Field. (I = 50°, h = 600 n mi)

Series II - Refinement of Geodetic Control Points, Separation of Factors Affecting Gravity Potential. (I = 28° 27', h = 600 n mi)

Series III - Extend Control Point Determination to Higher Latitudes, Determination of Higher Order Mathematical Terms in Gravity Potential. (I = 67° 26', h = 500 n mi)

Series IV - Complete Global Coverage, More Complete Separation of Higher Order Terms in Gravity Potential. (I = 90° (Polar), H = 600 n mi)

Series V - Determination of Departure of Geoid from Figure of Revolution. (I = o (Equatorial) h = 600 n mi)

Series VI - Final Control Point Determination, Final Specification of Gravity Field, (I = 28° 27', h = 2000 n mi)

I = Inclination of Orbital Plane to Equator
h = Height of Perigee in Nautical Miles

BASIC FACTS

1. OBJECTIVE: a) Determination of size and shape of the earth and location of geodetic control points to an accuracy of 5 meters. b) Determination of the gravitational field of the earth to an accuracy of one part in $10^5$.
2. Tri-service program under Navy management.
   - Army - Radio ranging (Secor) - Continuously measures range (Satellite to ground station).
   - Navy - Radio Doppler - Continuously measures rate of change of range.
   - Air Force - Optical - measures angular position of satellite against star background.
3. System funding includes costs of satellites, launch vehicles, orbit determination and calculation of a unified geodetic system to achieve objective.
4. System funding excludes costs of ground station instrumentation, data acquisition and analysis by each service.
5. $5.338M. FY 62 included in project transit funds. $5.0M must be reprogrammed in FY 62.
6. Assist. Sec. Navy, Army, Air Force (R&D) agreed to reprogram (1/3 each) $5.0M for back-up launch vehicle (Thor-Able Star).

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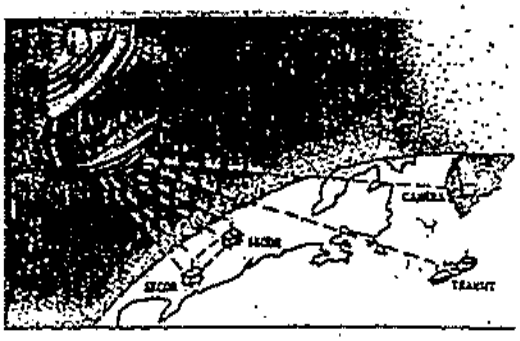
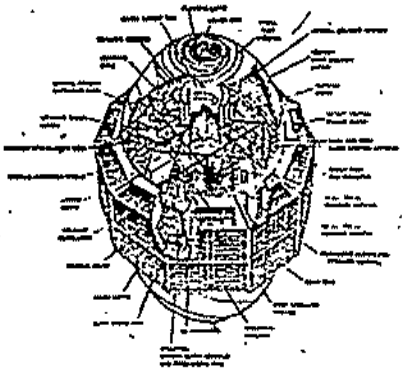
# ANNA — NAVY

(Contractor-
APPLIED PHYSICS LAB., J.H.U.)

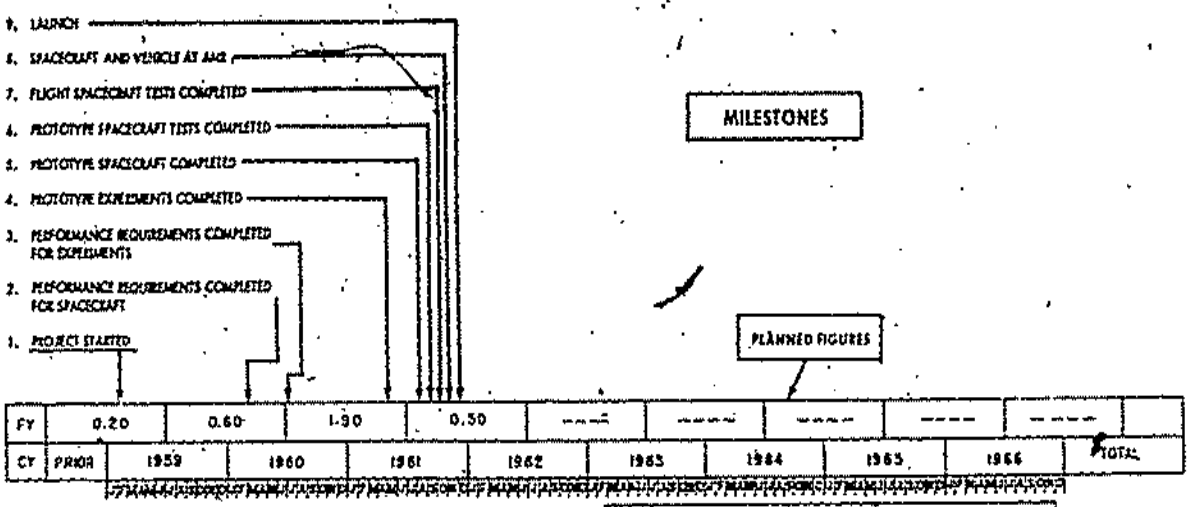


The Project ANNA system consists of the satellite, tracking networks, communication networks and computation and analysis. The satellite is shown in cut-away form above and is basically the same as the TRANSIT III-B package to reduce engineering costs. The sphere is 36 inches in diameter, the solar cell belt is 42 inches in diameter and the launch weight is estimated to be 325 pounds. The tracking networks are set up by each Service. The Navy network is basically the TRANSIT network plus several portable tracking stations. The Army network consists of 4 stations which will be moved, as a network, around the world. The Air Force network consists of 12 portable camera stations which will be moved to required locations. The orbit determination and station clocks will probably be performed by the Naval Weapons Laboratory, Dahlgren, Va. Communications and telemetry will be handled by a ground station and control center located at the Applied Physics Laboratory, John Hopkins University. Project ANNA utilizes complementary systems developed by the three Services which involve different parts of the electromagnetic spectrum, visible light and radio (100-500 megacycles). These systems, Doppler (Navy), SECOR-Sequential Collation of Range-(Army), and Flashing Light (Air Force) will use one or more of several basic geodetic satellite techniques (long or short arc orbital and intervisible). ANNA satellites I, II, and III are planned to be launched using the THOR-ABLE-STAR vehicle. ANNA satellites IV and V are planned to be launched with an improved SCOUT vehicle. ANNA satellite VI is planned to be launched with a modified THOR-ABLE-STAR denoted THOR-AREO-STAR.

# ATMOSPHERIC STRUCTURE SATELLITE

NASA



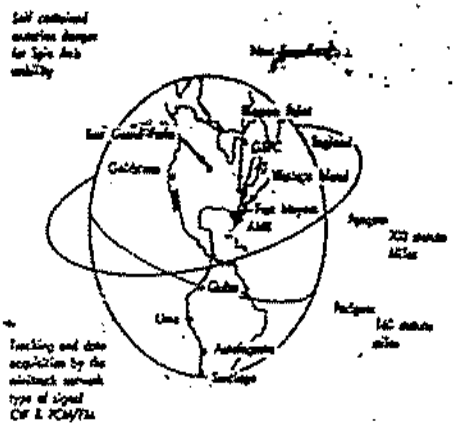

**BASIC FACTS**

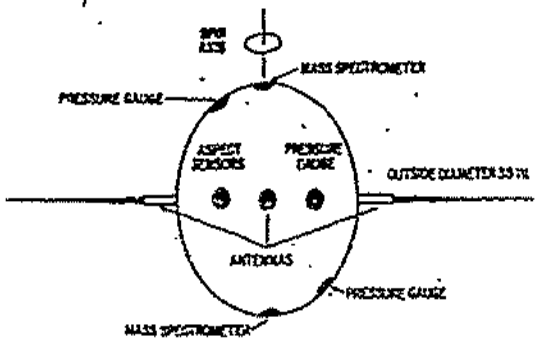
1. Objective: Measure the density, composition, pressure, and temperature of the Earth's atmosphere from 150 to 700 statute miles.
2. Satellite will weigh 379 pounds.
3. The tracking and data acquisition and command will be by the minitrack network.
4. Satellite is designed and constructed by the Goddard Space Flight Center. The spacecraft shell is manufactured by the Reid Corporation.
5. Delta vehicle funds not shown (Funded under vehicle development).

# ATMOSPHERIC STRUCTURE SATELLITE

NASA

PRIME CONTRACTOR: DESIGNED & CONSTRUCTED BY GSFC
RIDD CORP, SATELLITE HOUSING




SATELLITE

Weight: 330 pounds
Orbit: Apogee - 300 nautical miles, Perigee-140 nautical miles
Orbit inclination - 37°
Instrumentation and Sensors:
Two mass spectrometers
Two Beyard Alpert Hot Cathode Ionization Gages
Two Redhead Type Pressure Gages
Two Electron Temperature Probes
Two Aspect Sensors: Sun/Moon and Earth
Power Sources: Battery Pack of Silver Zinc batteries
Stability and Control System:
Magnetic Damper, Commercial System for Electronics and Experiments
Propulsion System: Thor Delta Vehicle
Signals:
Tracking 136 .360 Mc CW
Telemetry 136 .220 Mc PCM/FM

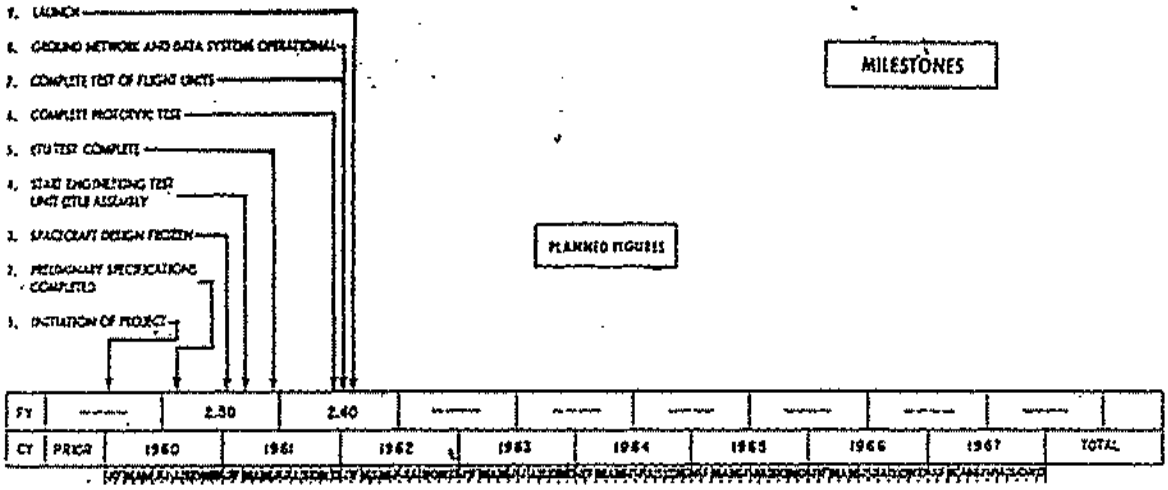
GROUND SYSTEM

Tracking & Data Acquisition System: FCM System with tracking & data Acquired by the Minitrack Network - Blossom Point, Quito, Antigua, Fort Myers, Lima, Antofagasta, Santiago, Woomera, Johannesburg, Goldstone Lake, Fort Grand Forks, St. John, Newfoundland, Winkfield, England.
Computer and Data Reduction: GSFC
Launch Site: ASR

DATA

Atmospheric pressures over the range of $10^{-6}$ to $10^{-12}$ mm Hg, and density. Satellite diagnostic measurements i.e., temperature, pressure, and correct. Measurement of molecular mass units over range of 1 to 29. Electron temperature.

# INTERNATIONAL PROGRAM SATELLITES UK NO. 1 AND UK NO. 2




EVENTS

**BASIC FACTS**

1. Objectives: U.K. No. 1 - Electron density and temperature near the satellite. Measurement of the primary cosmic ray energy and of x-ray and Lyman-α radiation from the sun. Mass spectrum of the ions is also an objective.

   U.K. No. 2 will measure:
   a. the number, size, and distribution of micrometeorites in the orbit of the satellite;
   b. galactic noise in the 0.75 to 3.0 Mc region; and
   c. ozone in the upper atmosphere at sunrise and sunset.

2. The minitrack network will be used for data acquisition.

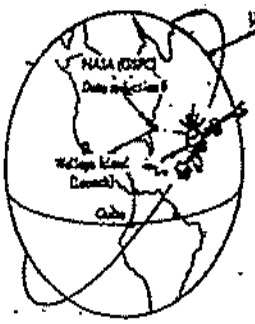
3. Additional International Program satellites are planned; however, only U.K. No. 1 and No. 2 have been defined.

# INTERNATIONAL PROGRAM SATELLITES

## UK No. 1 & UK No. 2

### UK & NASA

PRIME CONTRACTOR IN HOUSE




U.K. NO. 1

U.K. No. 2 will keep the basic configuration of U.K. No. 1

**SATELLITE**

U.K. No. 1

Weight: 140 pounds
Orbit: Perigee - 220 statute miles; Apogee - 600 statute miles; Inclination - 53°
Instrumentation & Sensors:
(1) Langmuir probe
(2) Electron density probe
(3) Cosmic ray analyzer using a Geneiger detector
(4) Ion mass spectrometer probe
(5) Solar aspect sensor
(6) Solar X-ray detectors
Power Sources: Solar cells and rechargeable batteries
Stabilization & Control System: Spin stabilized
Propulsion System: None
Signals: PAM/FM telemetry transmitter 136-137 Mc.

U.K. No. 2

Weight: 140 pounds
Orbit: Perigee - 225 statute miles; Apogee - 1500 statute miles; Inclination - 53°
Instrumentation & Sensors:
(1) Four micrometeorite detectors
(2) Two detectors for ozone scanning experiment
(3) Two broadband ozone sensors (photocells)
(4) Galactic noise receiver
Power Sources: Solar cells and rechargeable batteries
Stabilization & Control System: Spin stabilized
Propulsion System: None
Signals: PAM/FM telemetry 136-137 Mc.

**GROUND SYSTEM**

U.K. No. 1 & U.K. No. 2

Tracking & Data Acquisition System: Minitrack
Computer & Data Reduction: NASA (GSFC) and United Kingdom
Launch Site: Wallops Station, Virginia

**DATA**

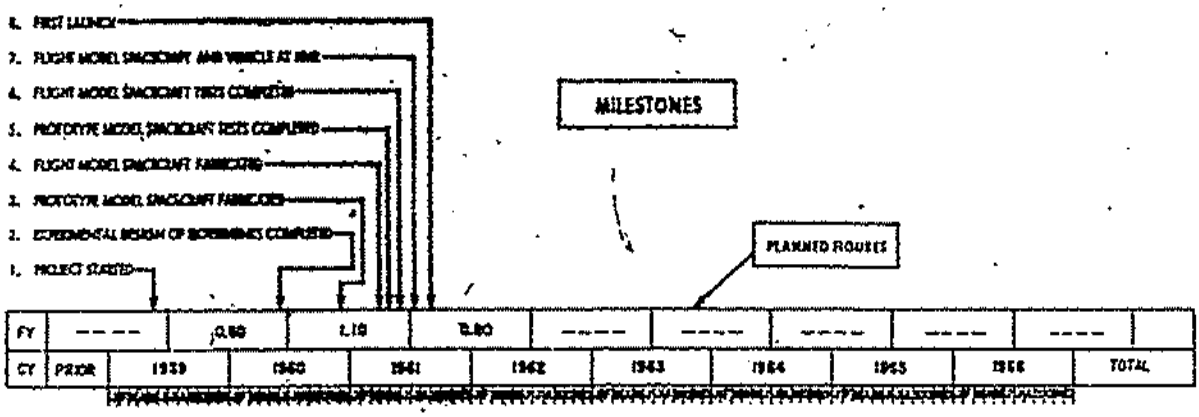
U.K. No. 1

(1) Electron density and temperature near the satellite
(2) Measurement of the primary cosmic ray energy
(3) Mass spectrum of the ion
(4) Measurement of X-ray and Lyman-alpha emission from the sun
(5) Solar aspect

U.K. No. 2

(1) Number, size, and distribution of micrometeorites in the orbit of the satellite.
(2) Ozone data
(3) Galactic noise in the region 0.75 to 3.0 Mc.

# ENERGETIC PARTICLES SATELLITE



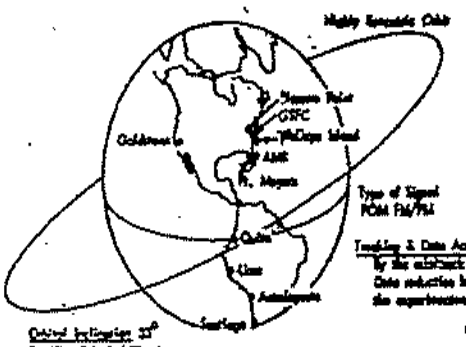

EVENTS

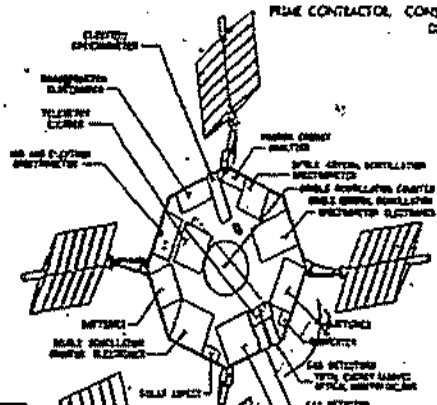
BASIC FACTS

1. Objectives: Measure the particle fluxes, types and energies in the Van Allen radiation belt as functions of position, direction and time; study long period time variations in the primary cosmic ray intensity.
2. Spacecraft will be launched into a highly eccentric orbit; apogee 22,000 statute miles; perigee 150 statute miles. Orbital inclination 33 degrees.
3. Spacecraft weight will be 83 pounds.
4. Tracking and telemetry will be acquired by the minitrack network. Radar coverage will be attained from Trinidad.
5. Satellite designed and constructed by the Goddard Space Flight Center. Two satellites of this type are now planned.
6. Delta vehicle funds not shown (funded under vehicle development).

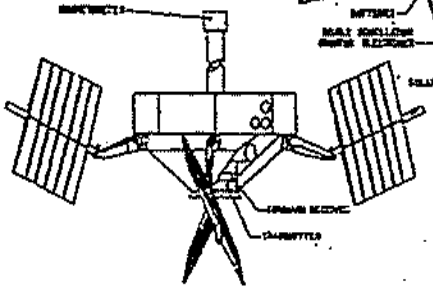
# ENERGETIC PARTICLES SATELLITE

**NASA**




PRIME CONTRACTOR, CONSTRUCTION AND DESIGN BY GSFC



**SATELLITE**

Weight: 83 pounds
Orbit - Apogee - 46,000 S Miles Perigee - 150 S Miles
Orbit Inclination - 33°
Instrumentation and Sensors:
- A. Proton Analyzer (Electrostatic Separator)
- B. Magnetic Field (Magnetometer)
- C. Cosmic Ray (GM Counters, Cadmium Sulfide Sensor,
- D. Mass Spectrometer)
- E. GM Telescope
- F. Double Scintillation Telescope
- G. Surface Particle Damage
- H. Ion Electron Detector

Power Sources: Silicon Solar Cells
Silver Cadmium Battery Pack
Stability and Control System: Spin Stabilization
Propulsion System: Thor Delta Vehicle
Signals: Tracking & Telemetry 108.02 Mc
Type of Modulation - PCM-FM/FM, Power 2 watt

**GROUND SYSTEM**

Tracking & Data Acquisition System:
- (1) Minitrack
- (2) Network, Johannesburg, Woomera, Antofagasta, Lima, Quito, Goldstone Lake, Santiago, Blossom Point, Fort Meyers

Computer & Data Reduction: GSFC
Launch Site: AMR

**DATA**

Particle Fluxes, Van Allen Belt Radiation Types, and Energies, Trapped Particles, Cosmic Radiation, Earth Magnetic Field data

# FIXED-FREQUENCY TOPSIDE SOUNDER (U. S.)

CONFIDENTIAL

8. LAUNCH S-48 SPACECRAFT
7. LAUNCH VEHICLE AND SPACECRAFT ON STAND
6. GROUND SYSTEMS OPERATIONAL AND DATA PROCESSING SYSTEMS COMPLETED
5. S-48 FLIGHT UNITS ASSEMBLED AND TESTED
4. S-48 PROTOTYPE SPACECRAFT ASSEMBLED AND TESTED
3. LAUNCH PRELIMINARY PAYLOAD WITH ALOUETTE
2. PRELIMINARY SPACECRAFT SPECIFICATIONS COMPLETED
1. INITIATION OF PROJECT

MILESTONES

PLANNED FIGURES

| FY | 63 | 64 | 65 | ---- | ---- | ---- | ---- | ---- | ---- | |
|---|---|---|---|---|---|---|---|---|---|---|
| CY | PRIOR | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | TOTAL |

EVENTS

**BASIC FACTS**

1. Objectives: To measure the electron density distribution in space and time between the height of the maximum electron density of the $F_2$ layer (250 - 400 km), and the height of the satellite (500 - 1200 km), including the geometry and number of any irregularities; to measure by indirect means the plasma resonance frequen.. in the neighborhood of the satellite; to estimate the cosmic noise level in the 3 to 10 mc region.
2. This is one of two satellites in the Topside Sounder program. The other one, the Swept Frequency Topside Sounder, is a cooperative program with the DRTE of Canada.
3. The minitrack network plus the Canadian stations and those of the U. K.

CLASSIFICATION CHANGE
To ... Unclassified
By authority of ... 12-19-72
Changed by ... Unc 3-3-73

CONFIDENTIAL

# Military Uses of Space: 1946-1991

**Published by:**
Chadwyck-Healey Inc., 1101 King Street, Alexandria, Virginia 22314

Military Uses of Space: 1946-1991 provides a detailed record of the strategic importance of the U.S. military space program from the conceptualization of the uses of space to the present realization of advanced capabilities. Materials were identified, obtained, assembled, and indexed by the National Security Archive, a non-profit, Washington, D.C. based research institute and library. The microfiche collection is accompanied by Military Uses of Space: 1946-1991 Guide and Index.

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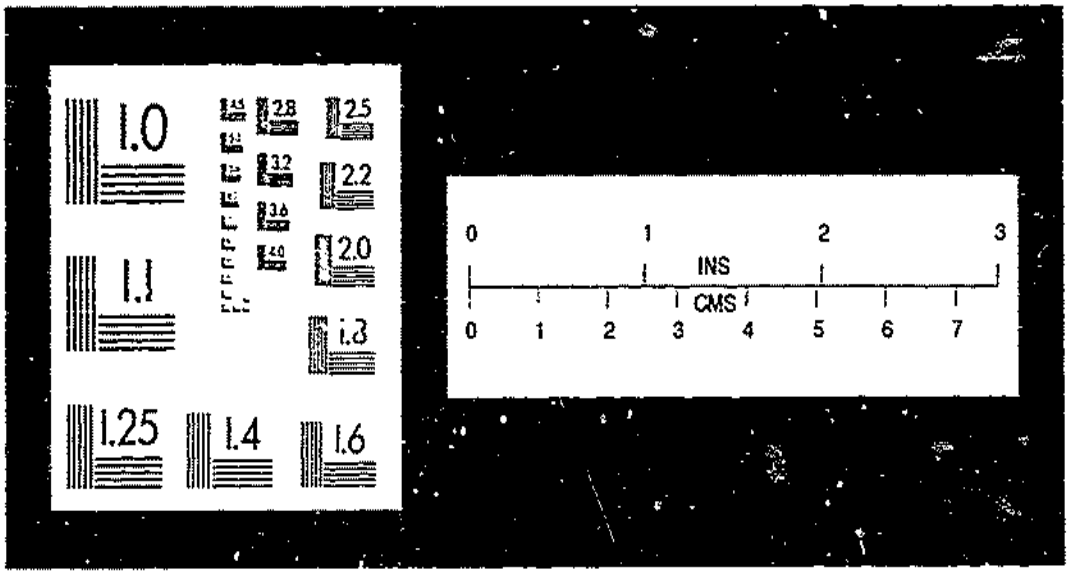
**Distribution Outside the USA:**
Chadwyck-Healey Ltd., Cambridge Place, Cambridge CB2 1NR, England



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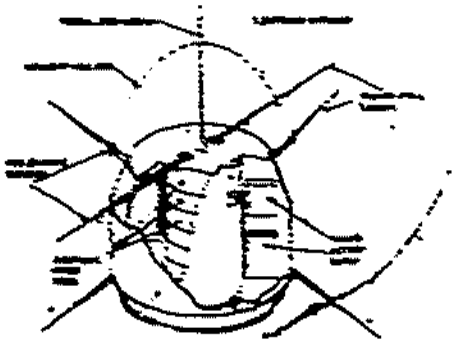
# FIXED FREQUENCY TOPSIDE SOUNDER (US)

NASA



# SWEPT-FREQUENCY TOPSIDE SOUNDER SATELLITE (CANADA)

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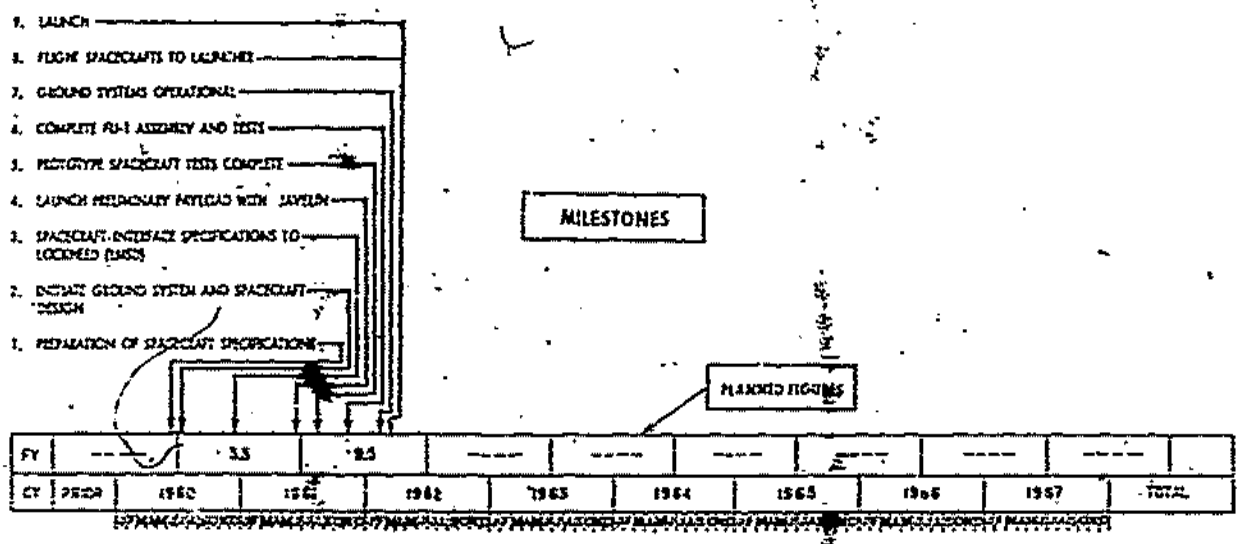



BASIC FACTS

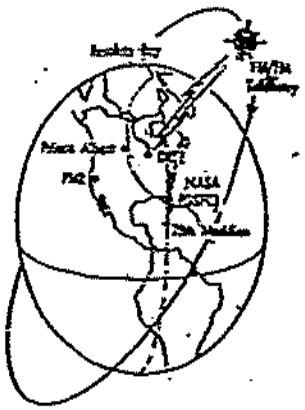
1. Objectives:
   a. To measure the electron density distribution in the ionosphere at altitudes between 200 and 1000 km.
   b. To study for a period of a year the variation of electron density distribution with time of day and with latitude, under varying magnetic and auroral conditions, and with particular emphasis on high latitude effects.
2. This is one of two satellites in the present Topside Sounder Program.
3. Funds shown include those for two Thor Agena vehicles.

# ALOUETTE

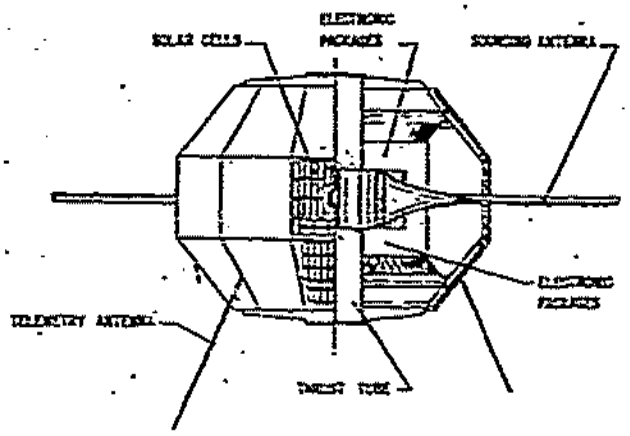
## SWEPT FREQUENCY TOPSIDE SOUNDER

**NASA**

PRIME CONTRACTOR: 1. DEFENCE RESEARCH TELECOMMUNICATIONS ESTAB., CANADA
2. RAYTHEON AIRCRAFT CO., CANADA




OPERATIONAL SCHEME:
Major stations will command on for twelve minute periods. U.K. stations will have a one minute overlap time.




TOPSIDE SOUNDER SATELLITE

**SATELLITE**

Weight: 370 pounds
Orbit: Circular - 625 statute miles; Inclination - 80° toward the east
Instrumentation & Sensors:
Transmitter 1.8 to 12 Mc
Pre/Post Operator
Satellite Receiver
Power Sources: Solar cells and rechargeable batteries
Stabilization & Control System: Spin stabilized
Propulsion System: Four Jayets
Signals:
(1) One FM/TM telemetry transmitter in 136-137 Mc band
(2) Topside sounder transmitter, 1-12 Mc.

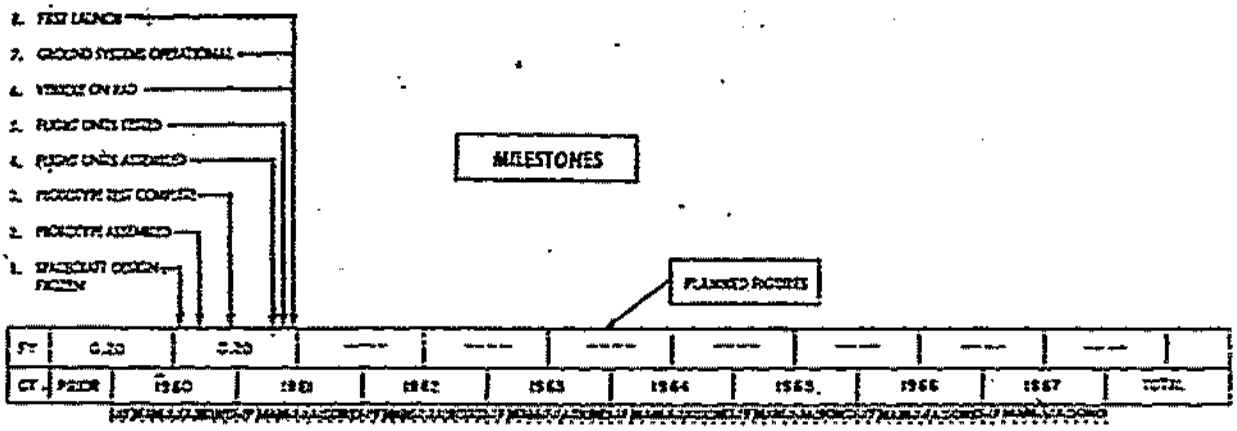
**GROUND SYSTEMS**

Tracking & Data Acquisition System:
(1) Mainback
(2) DRTE stations in Ottawa, Prince Albert & Resolute Bay - Canada
(3) U.K. stations in Singh, Singapore, & South Atlantic
Computer & Data Reduction:
Primary - DRTE, Ottawa, Canada
Secondary - NBS CRPL, Boulder, Colorado & Radio Research Station, Slough
Launch Site:
PMR

**DATA**

(1) Electron density distribution in the ionosphere at altitudes between 300 & 3000 KM.
(2) Variation of electron density distribution with time of day and latitude under varying magnetic & current conditions
(3) Electron density in the vicinity of the satellite by means of Galactic Noise Measurements

# MICROMETEOROID SATELLITE




EVENTS

BASIC FACTS

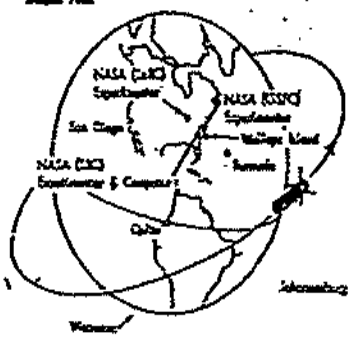
1. Objectives:
   a. To obtain a direct measure of the micrometeoroid puncture hazard to structural skin samples.
   b. To obtain data regarding the erosion of spacecraft materials due to small particles in space.
2. Data acquisition will be performed by [illegible] with on-the-data reduction and distribute data to experimenter for analysis.
3. Two satellites are presently planned to be launched on the Scout developmental vehicle. Cost of vehicles are not reflected in the above totals.

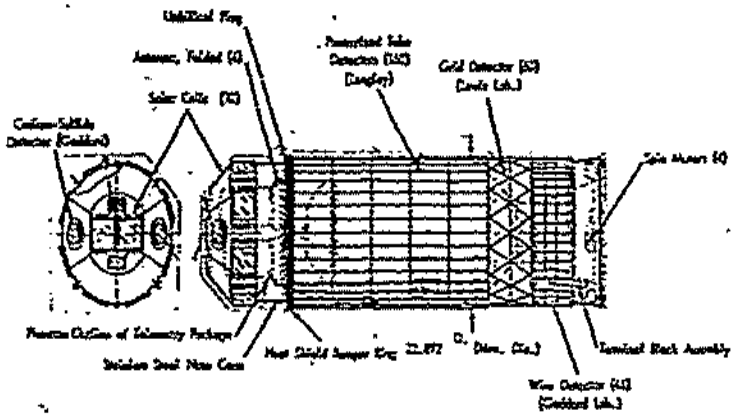
# MICROMETEOROID SATELLITE

**NASA**

PRIME CONTRACTOR: NASA/LTC

Command by:
Wallops Station
Bermuda
Johannesburg
Woomera
San Diego
Kaena Point




GENERAL ARRANGEMENT OF MICROMETEOROID SATELLITE

SATELLITE

Weight: 135 pounds
Orbit: Perigee-265 statute miles; Apogee-810 statute miles; Inclination-28°
Instrumentation & Sensors
(1) LTC pressure cells (4 thicknesses)
(2) GSFC wire grid detectors
(3) LTC foil gauge detectors
(4) Solar cells - current and temperature
Power Source: Solar cells and rechargeable batteries
Stabilization & Control System: Not stabilized, spinning
Propulsion System: None
Signals: Two PCM/FM/AM telemetry transmitters 136-137 Mc.

GROUND SYSTEMS

Tracking & Data Acquisition System: Minitrack
Computer & Data Reduction: LTC
Launch Site: Wallops Station, Virginia

DATA

(1) Direct measurement of the flux of micrometeoroids having a momentum range of $10^{-3}$ gm cm/sec or larger.
(2) Data of value of micrometeoroids having momenta in the range $10^{-3}$ to $10^{0}$ gm cm/sec or greater.
(3) Useful data for the design of solar cells for spacecraft.

# ORBITING ASTRONOMICAL OBSERVATORY

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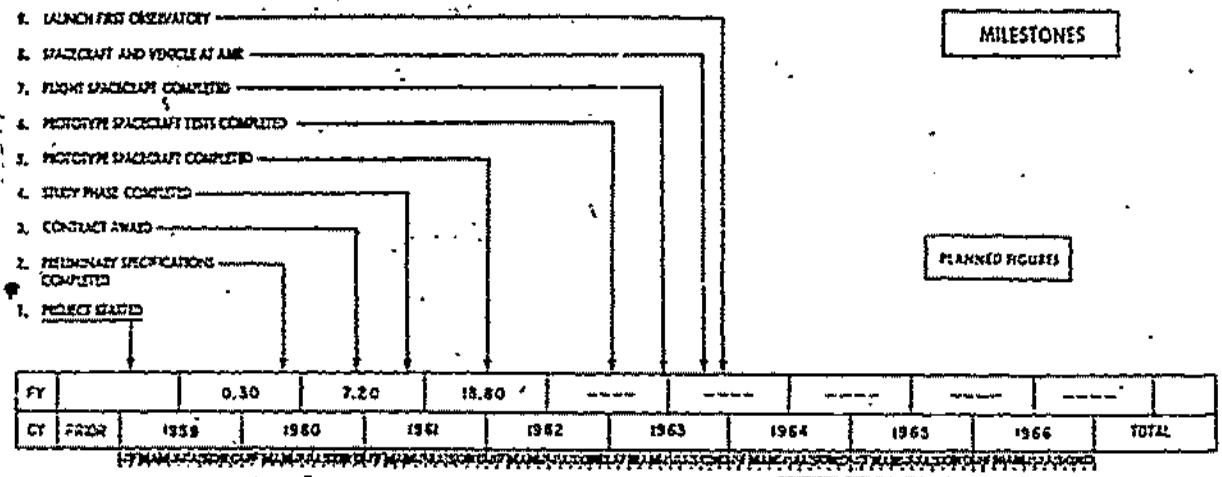



EVENTS

BASIC FACTS

1. Objective: Place into orbit a series of astronomical observatories above the absorbing atmosphere for precision (pointing accuracy 0.1 seconds). Telescopic observation of the emission and absorption characteristics of the sun, stars, planets, and nebulae in the ultraviolet, infrared and X-ray regions. It is desirable to have an operating observatory in space at all times.
2. Weight, 3550 pounds.
3. The orbit will be 500 statute miles circular.
4. Tracking and telemetry will be acquired by the minitrack network.
5. Data acquisition and processing - NASA (GSFC) and the experimenters.
6. Initial contract will deliver five flight spacecraft.



~~CONFIDENTIAL~~

# ORBITING ASTRONOMICAL OBSERVATORY

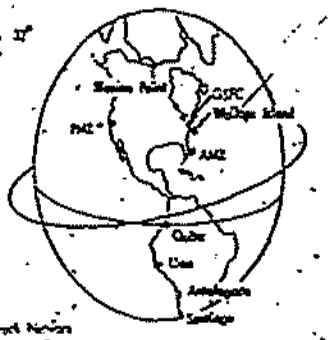
NASA

PRIME CONTRACTOR: GRUMMAN AIRCRAFT ENGINEERING CORP.

Circular Orbit

Orbit Inclination 33°

Orbit Stability Provided by inertia wheels and gas reaction jets




Two Minitrack Stations will be used for tracking and data acquisition


**SATELLITE**

Weight: 3000 pounds

Orbit: 500 nautical miles, circular; inclination 33°

Instrumentation & Sensors: Cassegrain type optical system, spectrometers, photometers, temperature sensors, voltage measuring instruments and specialized orientation instruments

Power Sources: Solar cell converter system with storage batteries

Stability and Control System: Coarse and fine gyro sensors, gimbal and free inertia wheels, auto sun control gas reaction, jet system to provide 3 torque control, star trackers, and magnetic unloading system for inertia wheels and coarse pointing scanner.

Propulsion System: Atlas - Agena B

Signals: Tracking frequency - 136.44 MC/S.
Modulated telemetry on command
Analog telemetry for television and experimental data - 400 KC
PCM modulation
Star sensors to solar pulses and digital sequence.

**GROUND SYSTEM**

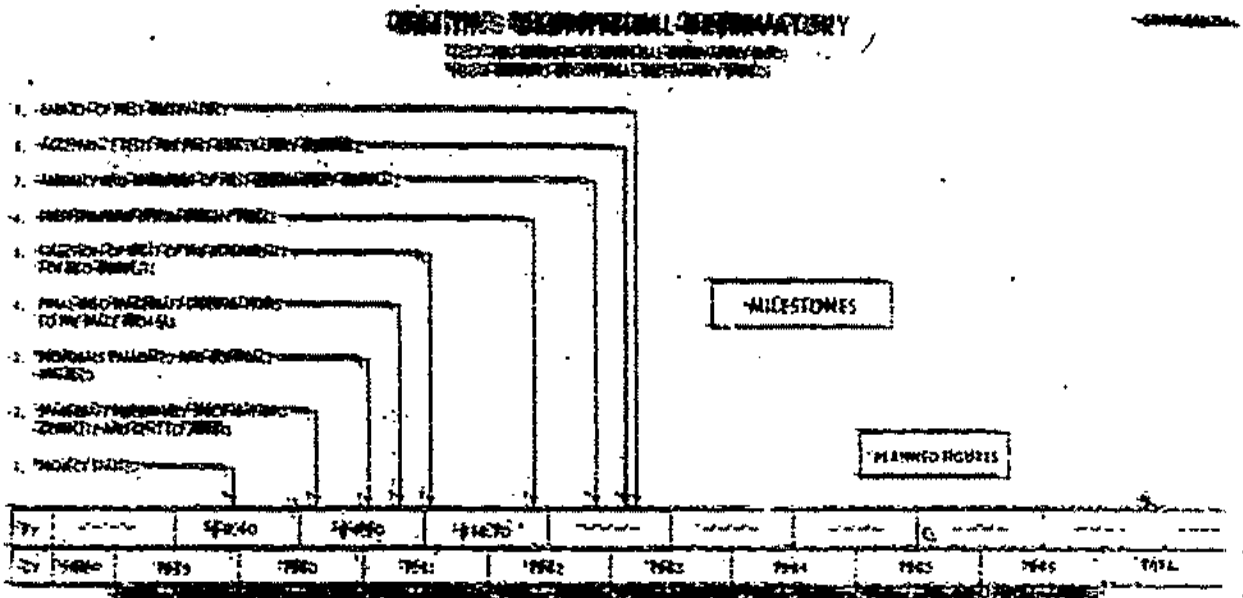
Tracking & Data Acquisition System: Minitrack Net, particularly Houston Point, Md., Quito, Ecuador and Santiago, Chile.

Computer & Data Reduction: Daily command operation GSFC and Houston Point data reduction by experimenters.

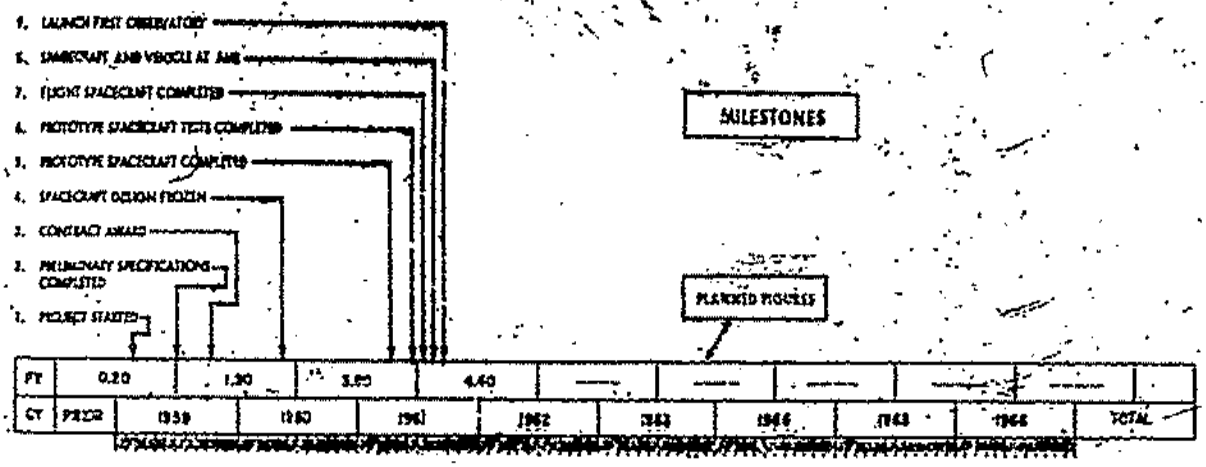
Launch Date: AMR

**DATA**

The following types of data will be obtained:
(1) Experimenters ultraviolet spectrographic.
(2) Experiment status and spacecraft status.


MILESTONES
PLANNED FIGURES
EVENTS

# ORBITING SOLAR OBSERVATORY






EVENTS

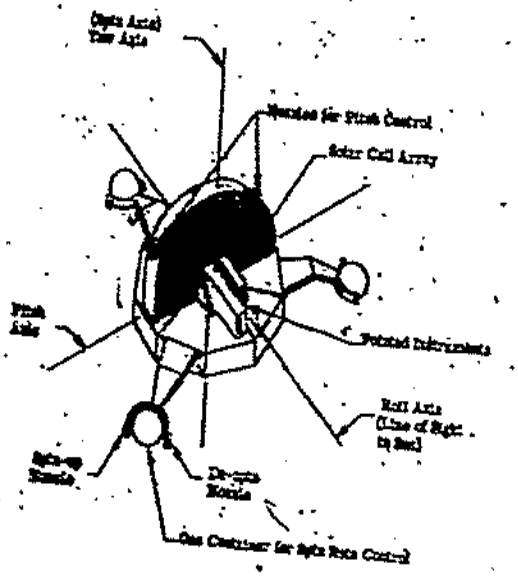
BASIC FACTS

1. Objectives: Place in orbit a series of solar observatories to conduct spectro-photometric studies on the electromagnetic radiations from the sun in the gamma, ultraviolet and x-ray regions of the spectrum. Performance of a Solar Pointing Control System will be determined. It is desirable to have an observatory in space at all times.
2. Observatory weight will be [illegible] pounds.
3. Orbit will be 345-statute mile circular inclination 30 degrees.
4. Tracking and data acquisition will be supplied by the minitrack network.
5. Data reduction and preprocessing will be done by NASA/GSFC. DATA analysis will be done by the experimenters.
6. Initial contract will deliver two spacecraft.

# ORBITING SOLAR OBSERVATORY

NASA

PRIME CONTRACTOR: BALL BROTHERS RESEARCH CORP.




LAUNCH

Weight: 440 pounds

Orbit: 325 statute miles, circular inclination 33°

Instrumentation & Sensors: Radiometer for ultraviolet, experimental monitor, broad band solar photometer, solar-oriented interferometer, solar multiplexer, X-ray monitor and spectrometer.

Power Sources: Solar cells and a nickel-cadmium storage battery pack.

Stability & Control System: Reaction wheel system provides gross attitude stability in daylight; gas jet system for velocity changes and precession of the spin axis; satellite despun and two lightweight booms for antenna and experiment mounting.

Propulsion System: Thiokol-Dyna

Signals: Command telemetry

Continuous command - 128.32 mc/s

Modulation is PM/PM

Telemetry is Digital, bi-polarized

GROUND SYSTEM

Tracking & Data Acquisition Stations: Blacksmith Lot, Quintahuara, Chile; Lima, Peru; Fort Myers, Fla.; Carnarvon, Australia; Hawaiian Point, Hawaii; Woomera, Australia; Santiago, Chile; and Quito, Ecuador; Californias, Johannesburg, South Africa.

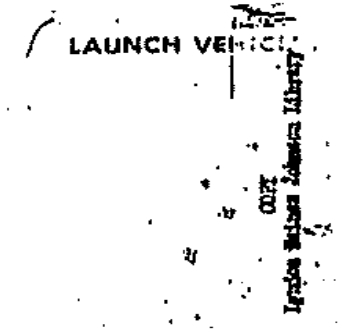
Computer & Data Reduction: NASA - GSFC

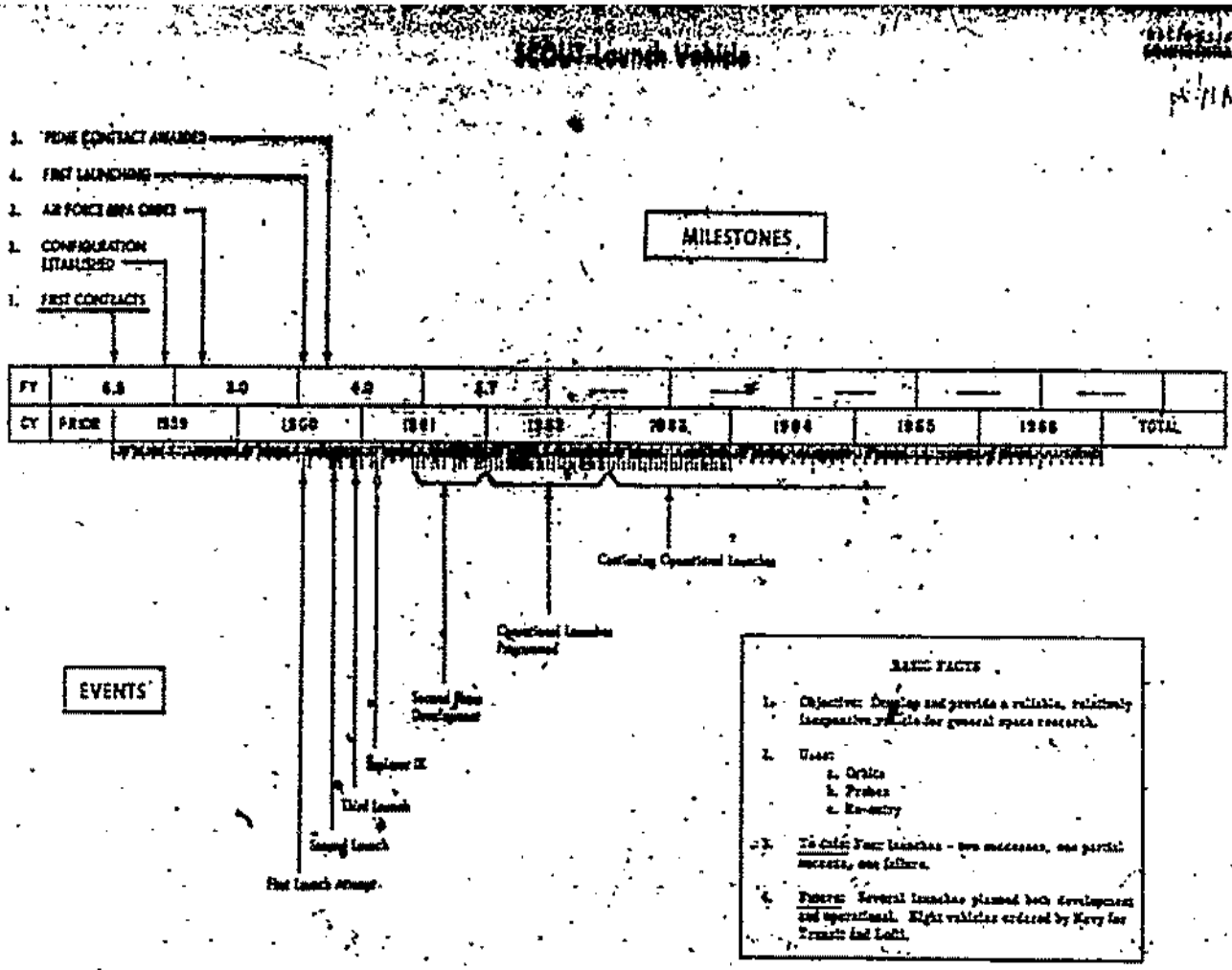
Launch Site: AMR

DATA

The following types of data will be obtained: Spectrophotometric, solar pointing control, solar radiation, gamma ray data on solar emission, neutron measurement and ambient celestial temperature.

COPY


LAUNCH VEHICLE

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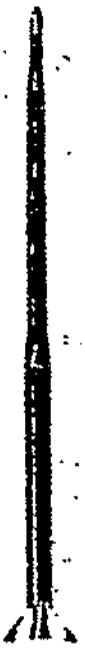
# SCOUT

## AIR FORCE / NASA



**GENERAL VEHICLE DATA**

| | |
|---|---|
| Height | 72 ft. |
| Max Diam. | 40 in. |
| Comp Wt.* | 34,000 lb. |
| Thrust (S.L.) | 100,000 lb. |

*Varies with payload

**VEHICLE CHARACTERISTICS**

| | Class | Stage 1st | 2nd | 3rd | 4th |
|---|---|---|---|---|---|
| Light-off Wt. | payload | 34,000 | 12,400 | 3,100 | 500 |
| Prop. Wt. | | 19,000 | 7,120 | 2,089 | 456 |
| No. of engines | | -1 | -1 | -1 | -1 |
| Total thrust | | 102,980 | 42,500 | 11,450 | 2,820 |
| Fuel | | Solid | - | - | - |
| Guidance | | - | - | - | - |

**MANUFACTURER**

| Vehicle | Contract Weight Comp. 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Engine | Aerojet | Thiokol | ABL* | ABL |
| Guidance | Minneapolis-Honeywell | | | |

*Allegheny Ballistic Lab.

**PERFORMANCE**

| | Escape | 24 hr. Equatorial | Mars | Soft Lunar |
|---|---|---|---|---|
| 300 N.M. orbit 150 lb. | - | orbit | Venus | Landing |

The SCOUT is a versatile four-stage solid propellant rocket which has been developed by NASA for launching a variety of relatively small payloads on both orbital and orbital trajectories. It is used by both NASA and DOD.

The first and second stages of BLUE SCOUT are identical to those of SCOUT. The third and fourth stages are arranged so as to permit the vehicle to withstand the additional bending stresses imposed by an increased payload volume. Modifications from the basic SCOUT provide for additional control tankage for the reaction jets to provide stabilization after burnout as well as during powered flight, altitude-stabilized payload carrier, and payload recovery capability.

SCOUT and BLUE SCOUT each have about the same payload capability.

Air Force has also developed a three-stage guided probe vehicle identical to BLUE SCOUT except that the fourth stage motor and jet control system are omitted thereby providing additional payload volume. This vehicle can carry a 200-lb. payload to an altitude of about 1500 miles.

BLUE SCOUT JUNIOR is a small four-stage probe vehicle which is capable of boosting 25-lb payloads to altitudes above 30,000 N.M. The first and second stage motors of BLUE SCOUT JUNIOR are the same as the second and third stage motors of BLUE SCOUT. A mountable SERGEANT launcher is utilized, providing versatility and possible field use.

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AIR FORCE

(Contractor
DOUGLAS AIRCRAFT CO. - THOR
AEROJET-GENERAL - ABLE-STAR)

## MILESTONES

2. TIME TO DECIDE TO CONTINUE PROGRAM

1. FIRST LAUNCH

PLANNED FIGURES

| FY | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|---|---|---|---|---|---|---|---|---|---|---|
| CY | PRIOR | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | TOTAL |
| LAUNCHES | | 4 | 7 | 2 | | | | | | |

## EVENTS

BASIC FACTS

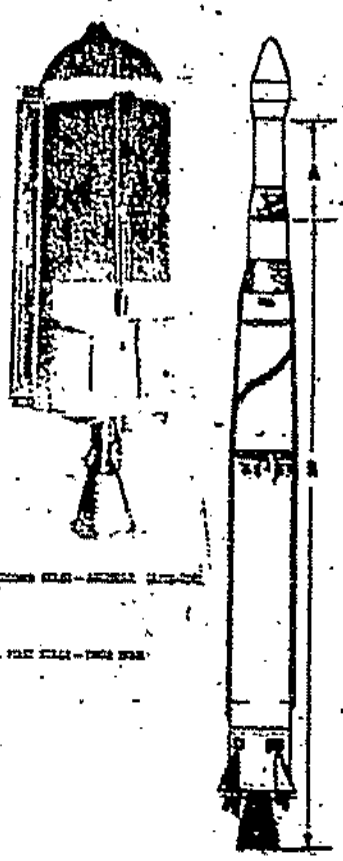
1. This vehicle is used for Navy TRANSIT and Army COURIER programs.

SECRET

SECRET

# THOR-ABLE-STAR

## AIR FORCE



### GENERAL VEHICLE DATA

| | |
|---|---|
| Height | 70.2 ft |
| Max. Diam. | 8 ft |
| Gross Wt. | 117,700 lb |
| Thrust (S.L.) | 150,000 lb |

### MANUFACTURER

| | 1st | 2nd | 3rd |
|---|---|---|---|
| Vehicle | Douglas | STL | |
| Engine | Rocketdyne | Aerojet | |
| Guidance | Douglas | STL | |

### VEHICLE CHARACTERISTICS

| | 1st | Stage 2nd | 3rd |
|---|---|---|---|
| Lift-off Wt. (less payload) | 120,000 | 10,100 | |
| Prop. Wt. | 101,000 | 8,300 | |
| No. of engines | 1 | 1 | |
| Total Thrust | 150,000 | 7,800 | |
| Fuel | RJ-1 | UDMH | |
| Oxidizer | $O_2$ | IRFNA | |

### PERFORMANCE

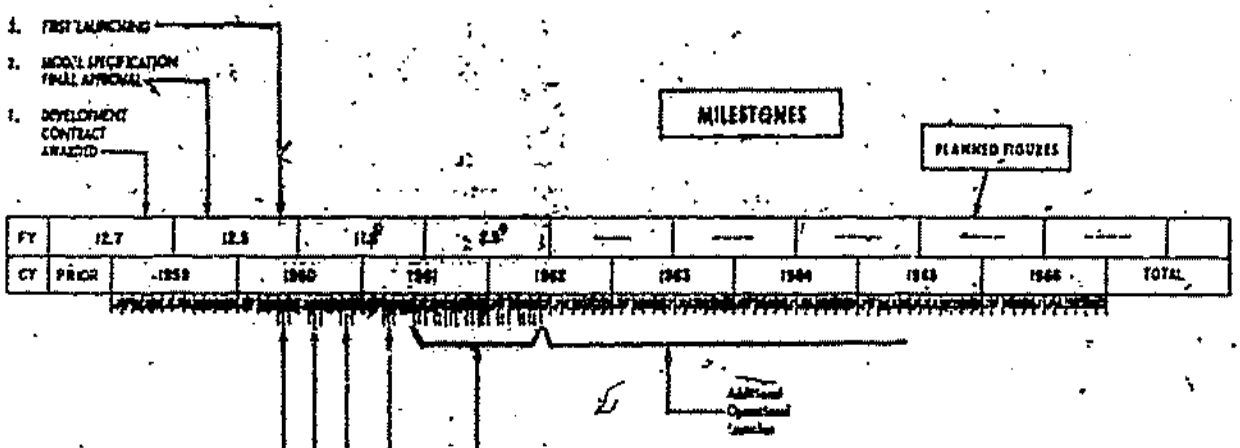
300 N.M. orbit — 700 lb

1000 N.M. orbit — 300 lb

The ABLE-STAR upper stage vehicle contains an AJ10-104 propulsion system which is an advanced version of earlier Aerojet General systems. In addition to providing increased performance capability, the system includes pyrotechnic staging, restarting, stabilizer, guided control, coast period pitch and yaw control, and ground monitoring systems. Propellants are fed to the thrust chamber by a high pressure helium gas system. The thrust chamber is gimballed by hydraulic actuators to provide pitch and yaw control during powered flight. Roll control during powered flight is achieved by expelling nitrogen through a system of nozzles in response to electrical signals. Roll control during coast periods uses a parallel circuit at lower thrust. Attitude control for coast periods up to one-half hour provided in the current design can be extended by increasing the nitrogen supply.

unclas
SECRET

# DELTA-Launch Vehicle




**BASIC FACTS**

1. Objective: Provide a reliable interim launch vehicle for medium weight satellites and small space probes.
2. Uses:
   a. Magnetosphere space probes.
   b. Meteorological satellites
   c. Passive communications satellites
   d. Active communications satellites
   e. Experimental commercial communications satellites
   f. Scientific satellites
3. To date: Four launches: three successes, one failure.
4. Future: Several Deltas planned in addition to original twelve.

CLASSIFICATION CHANGE
To: Unclassified
By authority of: [illegible]
Changed by: [illegible] Date: 12-13-77

# THOR DELTA

NASA

GENERAL VEHICLE DATA

| | |
|---|---|
| Height | 92 ft. |
| Base Dia. | 8 ft. |
| Gross Wt. @ L.O. | 111,000 lb. |
| Thrust (S.L.) | 150,000 lb. |

*Changes with payload

VEHICLE CHARACTERISTICS

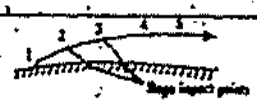
| Data | 1st | 2nd | 3rd |
|---|---|---|---|
| Lift-off Wt. payload | 111,000 lb. | 5,300 lb. | 715 lb. |
| Prop. Wt. | 97,000 lb. | 4,300 lb. | 600 lb. |
| No. of engines | 1 | 1 | 1 |
| Total thrust | 150,000 lb. | 7,800 lb. | 2,700 lb. |
| Fuel | RP-1 | UDMH | Solid |
| Oxidizer | $O_2$ | $HNO_3$ | – |

MANUFACTURE

| | Stage 1st | 2nd | 3rd |
|---|---|---|---|
| Vehicle | Douglas | Aerojet | Allegany |
| Engine | Rocketdyne | Aerojet | Allegany |
| Guidance | Douglas | Bell Tel. Lab. | |

PERFORMANCE – TYPICAL

| 300 N.M. | 24 hr. | Apogee | Inc. | Sub-Synchronous | Δ | Lower |
|---|---|---|---|---|---|---|
| 300 lb. | 90 | – | – | Varies | Leading | |




TYPICAL TRAJECTORY DATA (CIRCULAR ALTITUDE 300 N.M., PAYLOAD 300 lb.)

| Position | Condition | Time sec. | Altitude N.M. | Range N.M. | Velocity ft./sec. | Stage Impact N.M. |
|---|---|---|---|---|---|---|
| 1 | Launch | 0 | 0 | 0 | 0 | 0 |
| 2 | Stage 1 Burnout | 150 | 45 | 62 | 13,400 | 1195 |
| 3 | Stage 2 Burnout | 365 | 112 | 340 | 21,800 | 2360 |
| 4 | Stage 3 Ignition | 720 | 301 | 1529 | 25,300 | - |
| 5 | Stage 3 Burnout | 787 | 300 | 1729 | 24,800 | - |

CLASSIFICATION CHANGE
To ...
By authority of ...
Changed by ...
Date ...

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# THOR AGENA B

## MILESTONES

AIR FORCE-NASA

[Contractor
DOUGLAS AIRCRAFT CO. - THOR
LOCKHEED AIRCRAFT CO. - AGENA B]

5. FIRST NASA PAC LAUNCH
4. THOR/B VEHICLES TO CONTINUE PROGRAM WITHOUT INTERRUPTION
3. DISCOVERER XVI FIRST LAUNCH THOR-AGENA B
2. INITIATED PROCUREMENT
1. PROGRAM AUTHORIZED

## PLANNED FIGURES

| FY | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CY | PRIOR | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | TOTAL |
| LAUNCHES USAF | 6 | | 28 | | | | | | | |
| NASA | | | 1 | 3 | 3 | | | | | |

## EVENTS

### BASIC FACTS

1. Objective: A versatile launch vehicle for medium weight polar earth satellite missions.
2. Development initiated by ARPA. Transferred to USAF. Agena B is a larger improved version of Agena A with twice the fuel capacity and re-start capability.
3. [redacted]
4. Production rate of AGENA B is 3 per month.

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# THOR-AGENA B

## AIR FORCE / NASA

**GENERAL VEHICLE DATA**

| | |
|---|---|
| Height | 91 ft |
| Max Diam. | 8 ft |
| Gross Wt.* | 125,000 lb. |
| Thrust (S.L.) | 165,000 lb. |

*Changes with payload

**VEHICLE CHARACTERISTICS**

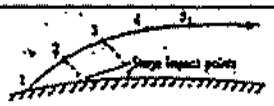
| | Stage | |
|---|---|---|
| | 1st | 2nd |
| Liftoff Wt. (less payload) | 122,200 lb. | 14,400 lb. |
| Prop. Wt. | 99,700 lb. | 12,800 lb. |
| No. of engines | 1 | 1 |
| Total thrust | 165,000 lb. | 16,000 lb. |
| Fuel | RP-1 | UDMH |
| Oxidizer | $O_2$ | IRFNA |

**MANUFACTURER**

| | Stage | |
|---|---|---|
| | 1st | 2nd |
| Vehicle | Douglas | Lockheed |
| Engine | Rocketdyne | Bell |
| Guidance | ? | |

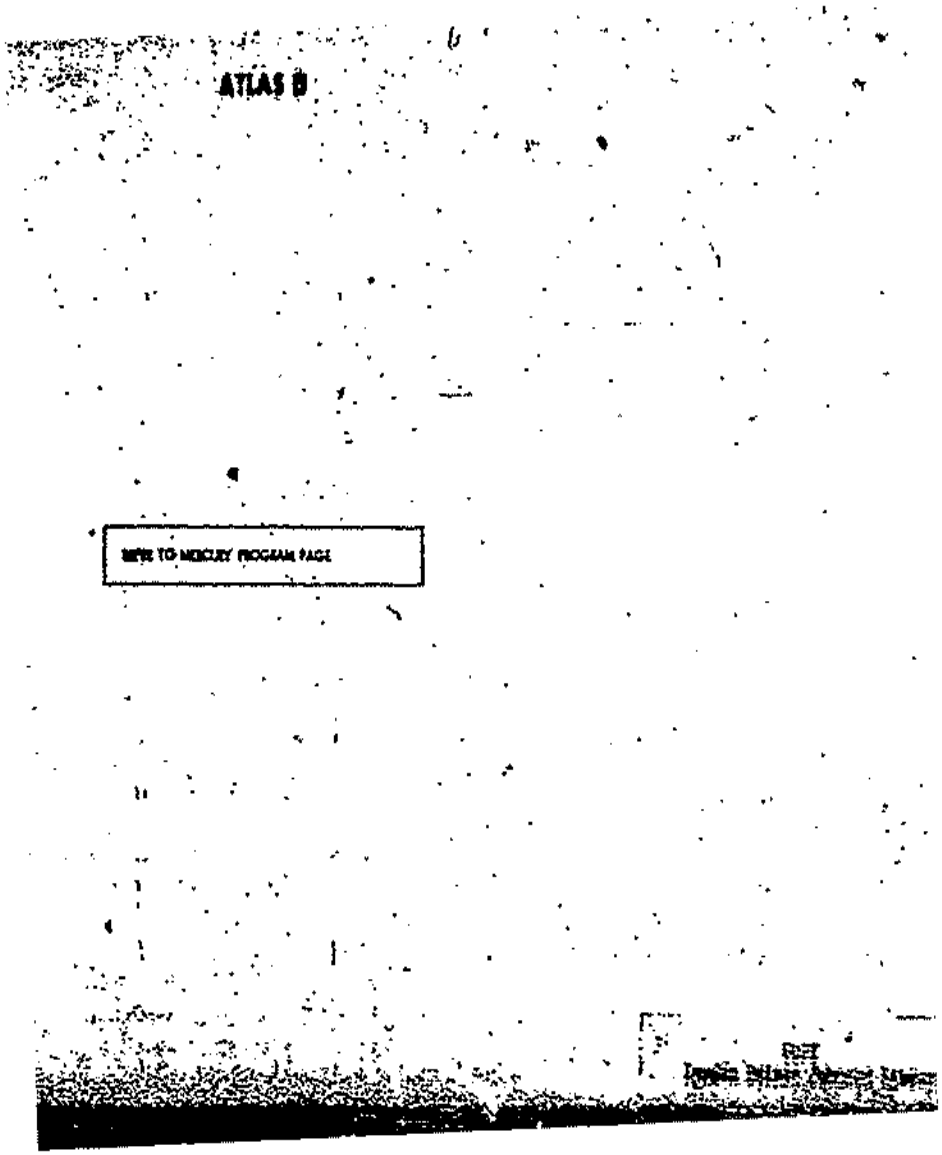
**PERFORMANCE**

| 300 N.M. orbit | Escape | 24 hr. Equatorial orbit | Moon | Lunar Landing |
|---|---|---|---|---|
| 1400 lb. | - | - | - | - |




TYPICAL TRAJECTORY DATA (CIRCULAR ALTITUDE 300 N.M., PAYLOAD 1400 lb.)

| Station | Condition | Time sec | Altitude N.M. | Range N.M. | Velocity ft/sec | Range Impact N.M. |
|---|---|---|---|---|---|---|
| 1 | Launch | 0 | 0 | 0 | 0 | 0 |
| 2 | Stage 1 Burnout | 136 | 42 | 75 | 10,500 | 600 |
| 3 | Stage 2 Shutdown | 420 | 80 | 370 | 24,000 | - |
| 4 | Stage 2 Maximum | 3157 | 300 | - | 24,500 | - |
| 5 | Stage 2 Impact | 3159 | 300 | - | 24,400 | - |


ATLAS B
REFER TO MERCURY PROGRAM PAGE

CONFIDENTIAL

# ATLAS D

NASA

GENERAL VEHICLE DATA

| | |
|---|---|
| Height | 75 ft. |
| Max. Dia. | 10 ft. |
| Gross Wt. * | 258,000 lb. |
| Thrust (S.L.) | 360,000 lb. |

* Fueled With Pad Load

VEHICLE CHARACTERISTICS

| | Sustainer (less payload) | 1st | Stage 1 1/2 |
|---|---|---|---|
| Liftoff Wt. | | 254,500 lb. | 45,500 lb. |
| Prop. Wt. | | 196,200 lb. | 43,200 lb. |
| No. of engines | | 3 | 1 |
| Total thrust | | 360,000 lb. | 82,000 lb. |
| Fuel | | LOX | LOX |
| Oxidizer | | RP-1 | RP-1 |

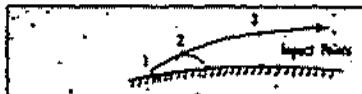
MANUFACTURE

| | 1st Stage | 1 1/2 |
|---|---|---|
| Vehicle | Convair | |
| Engine | Rocketdyne | |
| Guidance | G.E. | |

PERFORMANCE

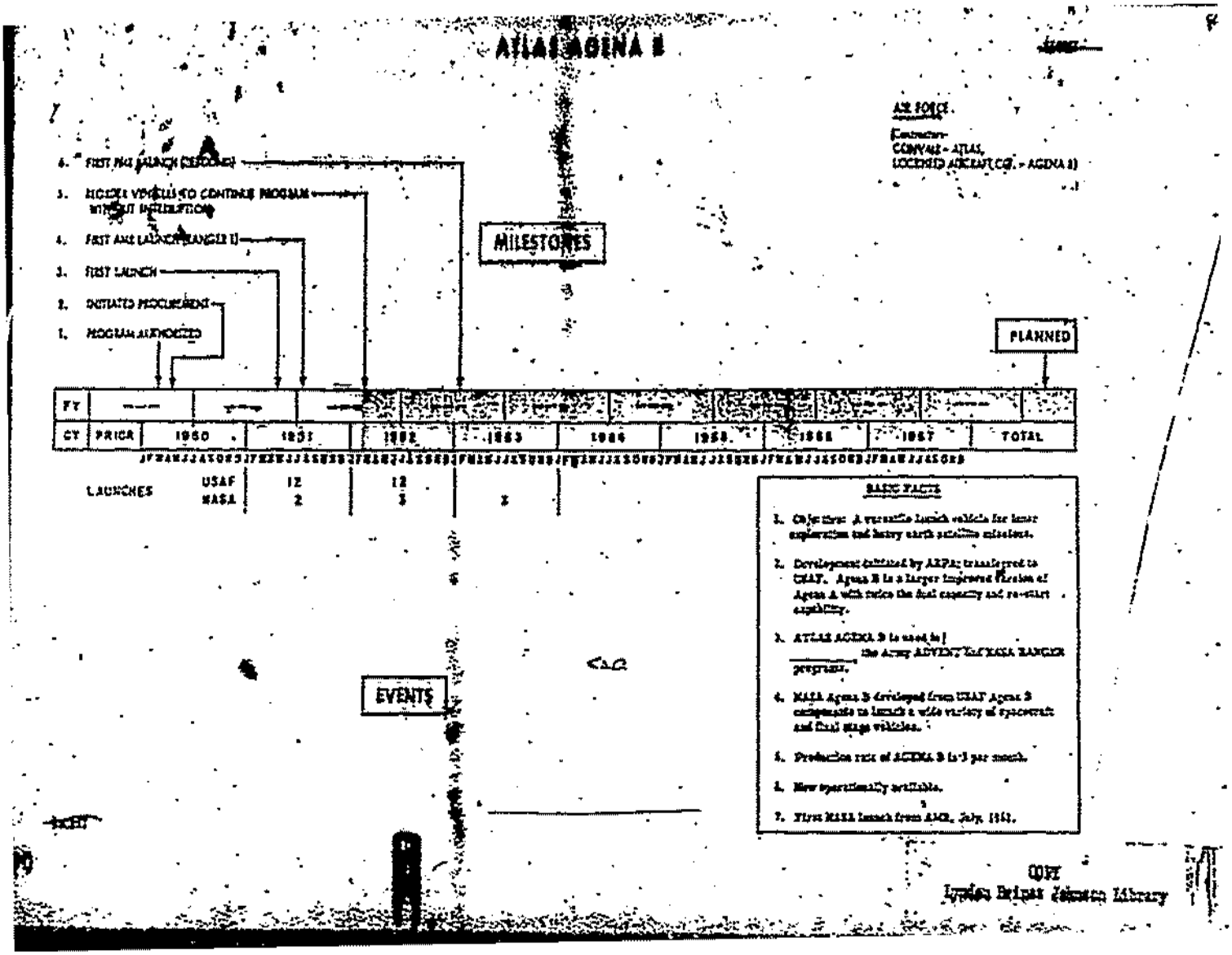
| 300 N.M. orbit | Escape | 24 hr. Equatorial Orbit | Moon & Venus | Soft Lunar Landing |
|---|---|---|---|---|

Launch vehicle for Mercury Capsule - Wt. = 2900 lb. orbit 100 N.M. (Escape Vehicle Wt. = 1120 lb.)




TYPICAL TRAJECTORY DATA (ORBIT ATTITUDE 300 N.M. - PAYLOAD 2800 lb.)

| Position | Condition | Time sec | Altitude N.M. | Range N.M. | Velocity ft/sec | Impact Points |
|---|---|---|---|---|---|---|
| 1 | Launch | 0 | 0 | 0 | 0 | - |
| 2 | Stage 1 Burnout | 151 | 35 | 69 | - | - |
| 3 | Stage 1 1/2 Burnout | 330 | 100 | - | 25,570 | - |



# ATLAS D-AGENA B

AIR FORCE/NASA

**GENERAL VEHICLE DATA**

| | |
|---|---|
| Height | 109 ft. |
| Max Diam. | 10 ft. |
| Gross Wt.* | 260,000 lb. |
| Thrust (S.L.) | 360,000 lb. |

*Varies with payload

**VEHICLE CHARACTERISTICS**

| Stage | 1st | 1 1/2 | 2nd |
|---|---|---|---|
| Liftoff Wt. (payload) | 225,000 lb. | 42,000 lb. | 14,000 lb. |
| Engine Wt. | 270,000 lb. | 36,000 lb. | 12,000 lb. |
| No. of engines | 3 | 1 | 1 |
| Total thrust | 360,000 lb. | 60,000 lb. | 16,000 lb. |
| Fuel | RP-1 | RP-1 | UDMH/ |
| Oxidizer | $O_2$ | $O_2$ | IRFNA |

**MANUFACTURE**

| Stage | 1st | 1 1/2 | 2nd |
|---|---|---|---|
| Vehicle | Convair | | Lockheed |
| Engine | Rocketdyne | | Bell |
| Guidance | - | | - |

**PERFORMANCE**

| | 24 hr. | Moon | Soft |
|---|---|---|---|
| 300 N.M. | Equatorial | & | Lunar |
| orbit | Escape | orbit | Venus | Landing |
| 5000 lb. | 200 lb. | - | - | - - |


TYPICAL TRAJECTORY DATA (ORBIT ALTITUDE ____ PAYLOAD ____)

| Position | Condition | Time sec | Altitude N.M. | Range N.M. | Velocity ft/sec | Inclination Relative |
|---|---|---|---|---|---|---|
| 1 | Launch | 0 | 0 | 0 | 0 | 0 |
| 2 | Stage 1 Burnout | 282 | 79 | 238 | 17,525 | 1108 |
| 3 | Stage 2 Ignition | 543 | 82 | 1123 | 24,120 | - |
| 4 | Stage 2 Injection | 2298 | 300 | 10,980 | 24,520 | - |
| 5 | Stage 2 Burnout | 2355 | 300 | 11,000 | 24,900 | - |

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# ATLAS CENTAUR-Launch Vehicle System

8. COMPLETE 30 VEHICLE DEVELOPMENT PHASE AND BEGIN OPERATIONAL PHASE
7. FIRST LAUNCH CARRYING ADVENT SPACECRAFT
6. ADVENT NET, WITH LASOP, BECOMES OPERATIONAL
5. FIRST VENUS PROBE (MARINER A SPACECRAFT)
4. FULL SCALE CENTAUR GROUND TESTS BEGIN AT AEDC
3. FIRST CENTAUR LAUNCH
2. CENTAUR ENGINE PFRT COMPLETED
1. LAUNCH COMPLEX 36 AT AMR COMPLETED

MILESTONES

PLANNED FIGURES

All figures include vehicle development and vehicle procurement costs (NASA mission only)

| FY | 56.5 | 60.5 | 61.5 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CY | PRIOR | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | TOTAL | |

Vehicle Design Phase

Vehicle Ground Testing Phase

Propulsion Test Flight Phase

Two Venus Probes (Mariner A)

Guidance Test Flight Phase

EVENTS

Y) denotes planned launches of Centaur for Advent Mission by DOD; units of these launched are not shown. Numbers denote NASA launches.

NASA launches will continue past CY 1965, but schedule is not known at this time.

BASIC FACTS

1. Objective: To provide a general purpose launch vehicle of high performance and reliability for Earth satellite, lunar and planetary exploration missions.
2. First ten vehicles constitute vehicle development phase.
3. World-wide NASA net and Advent net will be utilized for tracking and data collection.
4. Development started in October, 1958 in ARPA; transferred to NASA, July, 1959.
5. Advent vehicles schedule (Y)'s shown is designed to replace three satellites in orbit per year.
6. Planned uses include Mariner missions to Venus and Mars; Surveyor missions to soft lunar landings; Nimbus meteorological satellites; Relcomm communication satellites; and Advent (DOD) communication satellites.
7. The Centaur Vehicle development has progressed into ground testing phase; flight phase begins Nov. 1961.

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# ATLAS D-CENTAUR

## AIR FORCE/NASA

**GENERAL VEHICLE DATA**

| | |
|---|---|
| Height | 109 ft. |
| Max. Diam. | 10 ft. |
| Launch Wt. * | 255,000 lb. |
| Thrust (S.L.) | 360,000 lb. |

*Varies with payload

**VEHICLE CHARACTERISTICS**

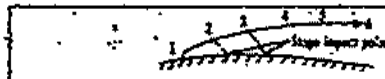
| | Booster | Stage 1 1/2 | 2nd |
|---|---|---|---|
| Light-off Wt. | payload | 256,000 lb. | 23,200 lb. |
| Prop. Wt. | | 225,000 lb. | 22,000 lb. |
| No. of engines | | 3 | 1 |
| Total thrust | | 360,000 lb. | 33,000 lb. |
| Fuel | | RP-1 | RP-1 |
| Oxidizer | | $O_2$ | $O_2$ | $O_2$ |

**MANUFACTURER**

| | 1st | Stage 1 1/2 | 2nd |
|---|---|---|---|
| Vehicle | Convair | Convair | Convair |
| Engine | Rocketdyne | Rocketdyne | Pratt & Whitney |
| Guidance | Minneapolis-Honeywell | Minneapolis-Honeywell | Minneapolis-Honeywell |

**PERFORMANCE**

| 300 N.M. orbit | Escape | 24 hr. Equatorial orbit | Moon | Soft Lunar Landing |
|---|---|---|---|---|
| 8800 lb. | 2300 lb. | 860 lb. | Varies | 1150 lb. 440 lb. |




**TYPICAL TRAJECTORY DATA (MDRS, PMR) PAYLOAD 1150 lb.**

| Position | Condition | Time sec | Altitude N.M. | Range N.M. | Velocity ft/sec | Impact Point |
|---|---|---|---|---|---|---|
| 1 | Launch | 0 | 0 | 0 | 0 | — |
| 2 | Stage 1 Burnout | 132 | 33 | 53 | 8,990 | |
| 3 | Stage 1 1/2 Burnout | 252 | 73 | 216 | 14,220 | |
| 4 | Stage 2 1st Ignition | 255 | 81 | 267 | 14,320 | |
| 5 | Stage 2 Shutdown | 555 | 89 | 1020 | 25,600 | |
| 6 | Stage 2 2nd Ignition | 1112 | 89 | | 25,600 | |
| 7 | Stage 2 Burnout | 1266 | 89 | | 26,200 | |

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# SATURN C-1

NASA

**GENERAL VEHICLE DATA**

| | |
|---|---|
| Height | 170 ft. |
| Max. Diam. | 22 ft. |
| Gross Wt. * | 1,320,000 lb. |
| Thrust (S.L.) | 1,500,000 lb. |

*Varies with payload

**VEHICLE CHARACTERISTICS**

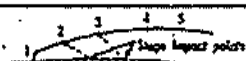
| | Stage | | | |
|---|---|---|---|---|
| | Thrust | 1st | 2nd | 3rd |
| Lift-off Wt. | payload | 1,080,000 lb. | 144,000 lb. | 35,000 lb. |
| Prop. Wt. | | 830,000 lb. | 98,000 lb. | 25,000 lb. |
| No. of engines | | 8 | 8 | 2 |
| Total Thrust | | 1,500,000 lb. | 90,000 lb. | 20,000 lb. |
| Fuel | | RP1 | $H_2$ | $H_2$ |
| Oxidizer | | $O_2$ | $O_2$ | $O_2$ |

**MANUFACTURE**

| | Stage | | |
|---|---|---|---|
| | 1st | 2nd | 3rd |
| Vehicle | MSFC | Douglas | Convair |
| Engine | Rocketdyne | Pratt & Whitney | Pratt & Whitney |
| Guidance | Minneapolis-Honeywell | | |

**PERFORMANCE**

| | | 24 hr. Equatorial | Mars | Soft |
|---|---|---|---|---|
| 300 N.M. orbit 20,000 lb. | Escape | orbit | Venus | Lunar landing |




**TYPICAL TRAJECTORY DATA (ORBIT ALTITUDE PAYLOAD )**

| Position | Condition | Time sec | Altitude N.M. | Range N.M. | Velocity ft/sec | Impact Points |
|---|---|---|---|---|---|---|
| 1 | Launch | | | | | |
| 2 | Stage 1 Burnout | | | | | |
| 3 | Stage 2 Burnout | | | | | |
| 4 | Stage 3 Ignition | | | | | |
| 5 | Stage 3 Burnout | | | | | |



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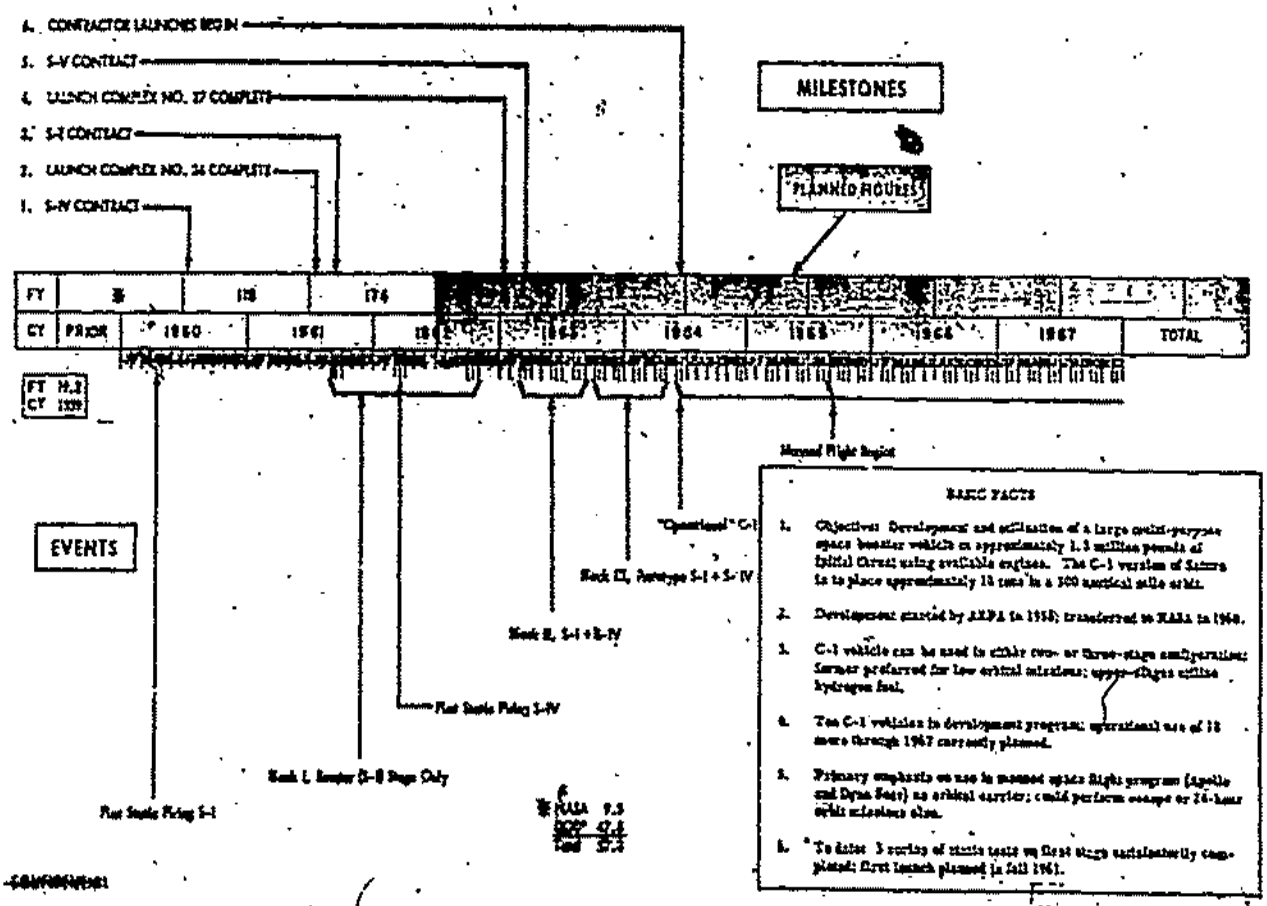
# SATURN C-1




BASIC FACTS

1. Objectives: Development and utilization of a large orbit-purpose space booster vehicle on approximately 1.5 million pounds of initial thrust using available engines. The C-1 version of Saturn is to place approximately 15 tons in a 300 nautical mile orbit.
2. Development started by ARPA in 1958; transferred to NASA in 1960.
3. C-1 vehicle can be used in either two- or three-stage configuration; former preferred for low orbital missions; upper-stages utilize hydrogen fuel.
4. Ten C-1 vehicles in development program; operational use of 10 more through 1967 currently planned.
5. Primary emphasis on use in manned space flight program (Apollo and Dyna Soar) as orbital carrier; could perform escape or 24-hour orbit missions also.
6. To date: 3 series of static tests on first stage satisfactorily completed; first launch planned in fall 1961.

CLASSIFICATION CHANGE
To Unclassified
By authority of [illegible]
Changed by [illegible]
Date 2-23-77

# SATURN C-2

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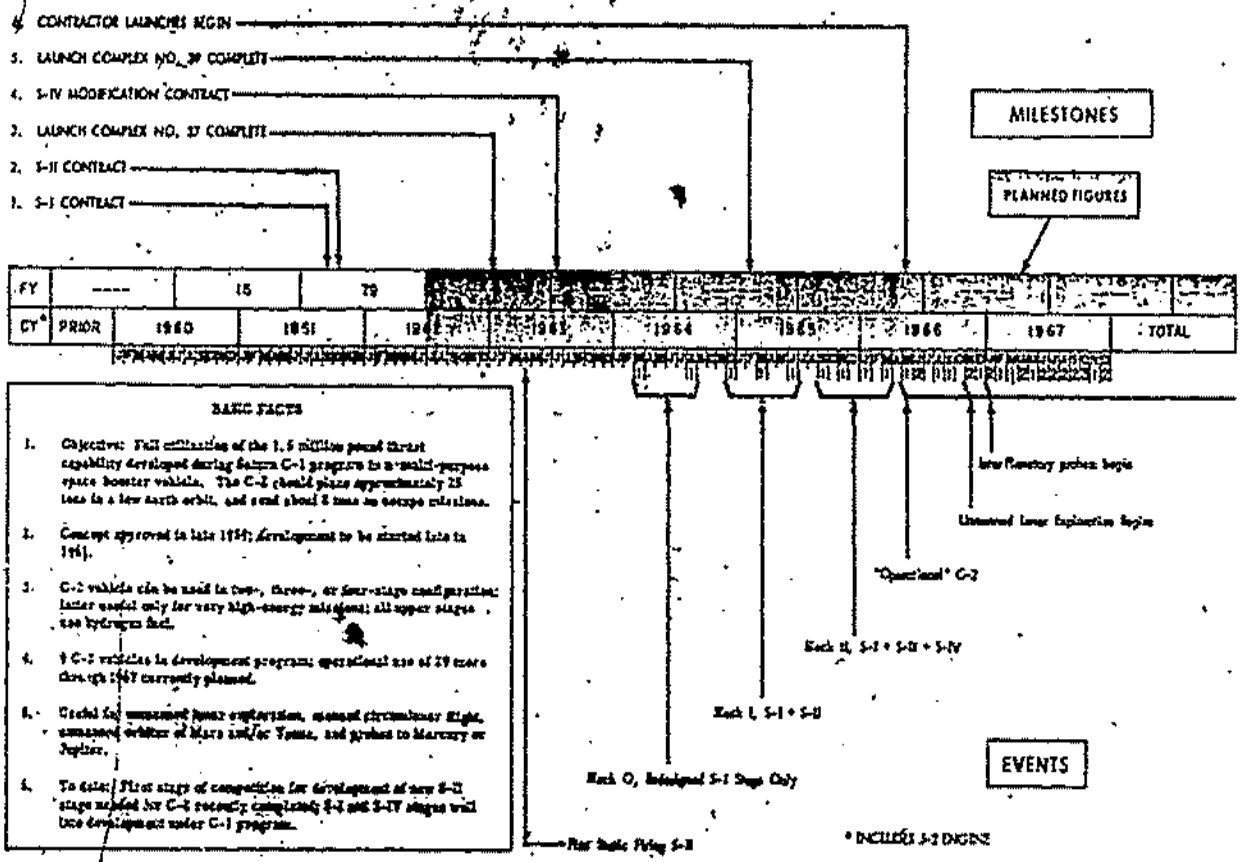


## BASIC FACTS

1. Objective: Full utilization of the 1.5 million pound thrust capability developed during future C-1 program in a multi-purpose space booster vehicle. The C-2 should place approximately 25 tons in a low earth orbit, and send about 8 tons on escape missions.
2. Concept approved in late 1959; development to be started late in 1961.
3. C-2 vehicle can be used in two-, three-, or four-stage configuration; latter useful only for very high-energy missions; all upper stages use hydrogen fuel.
4. 9 C-2 vehicles in development program; operational use of 29 more through 1967 currently planned.
5. Useful for unmanned lunar exploration, manned circumlunar flight, unmanned orbiter of Mars and/or Venus, and probes to Mercury or Jupiter.
6. To date: First stage of competition for development of new S-II stage needed for C-2 recently completed; S-I and S-IV stages will have development under C-1 program.

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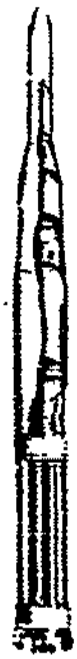
# SATURN C-2

NASA



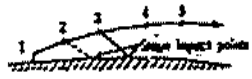
| GENERAL VEHICLE DATA | |
|---|---|
| Height | [illegible] ft. |
| Max. Dia. | 33 ft. |
| Gross Wt. * | [illegible] lb. |
| Thrust (S.L.) | [illegible] lb. |

*Varies with payload

| VEHICLE CHARACTERISTICS | | Stage | | |
|---|---|---|---|---|
| | | 1st | 2nd | 3rd |
| Lift-off wt. Less payload | | 1,120,000 lb. | 470,000 lb. | 100,000 lb. |
| Prop. wt. | | 950,000 lb. | 390,000 lb. | 97,000 lb. |
| No. of engines | | 5 | 5 | 1 |
| Total thrust | | 1,500,000 lb. | 800,000 lb. | 90,000 lb. |
| Fuel | | RP-1 | $LH_2$ | $LH_2$ |
| Oxidizer | | $O_2$ | $O_2$ | $O_2$ |

| MANUFACTURE | Stage | | |
|---|---|---|---|
| | 1st | 2nd | 3rd |
| Vehicle | MSFC | - | Douglas |
| Engine | Rocketdyne | Rocketdyne | Pratt & Whitney |
| | Minneapolis | | |
| Guidance | Honeywell | | |

| PERFORMANCE | | | | |
|---|---|---|---|---|
| 200 N.M. orbit | Escape | 24 hr. Synchronous orbit | Moon & Venus | Soft Lunar Landing |
| 41,000 lb. | 11,000 lb. | - | - - | - |




TYPICAL TRAJECTORY DATA FOR IC ALTITUDE - PAYLOAD )

| Position | Condition | Time sec | Altitude N.M. | Range N.M. | Velocity ft/sec | Impact point |
|---|---|---|---|---|---|---|
| 1 | Launch | | | | | |
| 2 | Stage 1 Burnout | | | | | |
| 3 | Stage 2 Burnout | | | | | |
| 4 | Stage 2 Ignition | | | | | |
| 5 | Stage 2 Burnout | | | | | |

CONFIDENTIAL

# SATURN C-3 OR NOVA-1

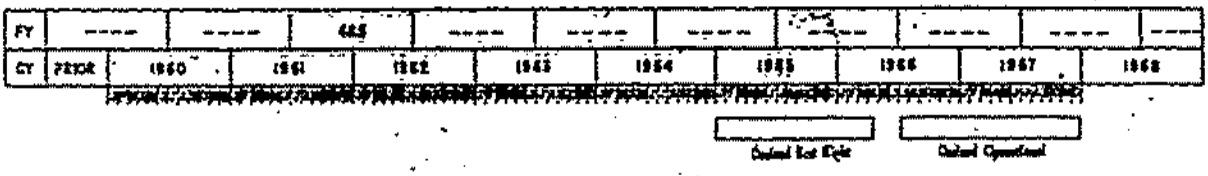
NASA

Secretary Seaton instructed to appeal to the Senate Armed Services Committee for restoration of funds for Saturn C-3 or Nova - 1 (in 2 million lb. thrust) to meet the objectives enunciated in the President's message to Congress on May 25, 1961.

# NOVA

MILESTONES

PLANNED FIGURES




EVENTS

BASIC FACTS

1. Objective: A launch vehicle capable of landing a man on the moon and returning him safely to earth.
2. First stage to use a cluster of either F-1 engines or solid motors.
3. Studies underway to determine vehicle configuration.

# NOVA

NASA

GENERAL VEHICLE DATA

| | | |
|---|---|---|
| Height | | [illegible] ft |
| Max Diam | | 30 to 60 ft |
| Gross Wt. | Liquid | 7 to 30 million lb. |
| | Solid | 6 to 12 million lb. |
| Thrust (S.L.) | Liquid | 9 to 12 million lb. |
| | Solid | 14 to 21 million lb. |

VEHICLE CHARACTERISTICS

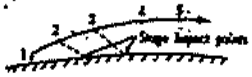
| | | Stage 1st | Stage 2nd | Stage 3rd |
|---|---|---|---|---|
| Number of engines | | 4-8 | 4-10 | 1 to 4 |
| Total thrust | All Liquid Propellant Launch Vehicles | 9 to 12 million lb. | | 1st stage |
| | | 2 to 4 million lb. | | 2nd stage |
| | | 200,000 to 1 million lb. | | 3rd stage |
| Total thrust | Solid-Liquid Launch Vehicle | | | |
| Solid | | 14 to 21 million lb. | | 1st stage |
| Solid | | 6 to 9 million lb. | | 2nd stage |
| | | 800,000 to 2 million lb. | | 3rd stage |
| | | 200,000 to 300,000 lb. | | 4th stage |

MANUFACTURE

| | Stage 1st | Stage 2nd | Stage 3rd |
|---|---|---|---|
| Vehicle | | | |
| Engine | | | |
| Guidance | | | |

PERFORMANCE

| 300 N.M. Orbit | Escape | 24 hr. Synchronous orbit | Moon Vicinity | Soft Lunar Landing |
|---|---|---|---|---|
| Manned Lunar Landing and Return, [illegible] lb. return Wt. | | | | |




TYPICAL TRAJECTORY DATA FOR[illegible] ALTITUDE PAYLOAD

| Position | Condition | Time sec | Altitude N.M. | Range N.M. | Velocity ft/sec | Impact Point |
|---|---|---|---|---|---|---|
| 1 | Launch | | | | | |
| 2 | Stage 1 Burnout | | | | | |
| 3 | Stage 2 Burnout | | | | | |
| 4 | Stage 2 Ignition | | | | | |
| 5 | Stage 2 Burnout | | | | | |

# NOVA

NASA

**GENERAL VEHICLE DATA**

| | | |
|---|---|---|
| Height | | 0 000 ft |
| Hot Mass | | 00 to 00 t |
| Gross Wt. | (Liquid) | 2 to 00 million lb. |
| | (Solid) | 0 to 00 million lb. |
| Thrust (S.L.) | (Liquid) | 0 to 00 million lb. |
| | (Solid) | 0 to 00 million lb. |

**VEHICLE CHARACTERISTICS**

| | Stage 1st | Stage 2nd | Stage 3rd |
|---|---|---|---|
| Number of engines | 4-8 | 4-16 | 1 to 4 |
| Total thrust | All Liquid Propellant Launch Vehicles | | |
| | 8 to 12 million lb. | | 1st stage |
| | 2 to 4 million lb. | | 2nd stage |
| | 400,000 to 1 million lb. | | 3rd stage |
| Total thrust | Solid-Liquid Launch Vehicle | | |
| (solid) | 14 to 21 million lb. | | 1st stage |
| (liquid) | 4 to 9 million lb. | | 2nd stage |
| | 800,000 to 2 million lb. | | 3rd stage |
| | 100,000 to 200,000 lb. | | 4th stage |

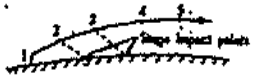
**MANUFACTURE**

| | Stage 1st | Stage 2nd | Stage 3rd |
|---|---|---|---|
| Vehicle | | | |
| Engine | | | |
| Guidance | | | |

**PERFORMANCE**

| 300 N.M. orbit | Escape | 24 hr. Synchronous orbit | Moon & Venus | Soft Lunar Landing |
|---|---|---|---|---|

Manned Lunar Landing and Return
0 to 00,000 lb. minus Wt.




TYPICAL TRAJECTORY DATA ABOVE ALTITUDE ... (PAYLOAD)

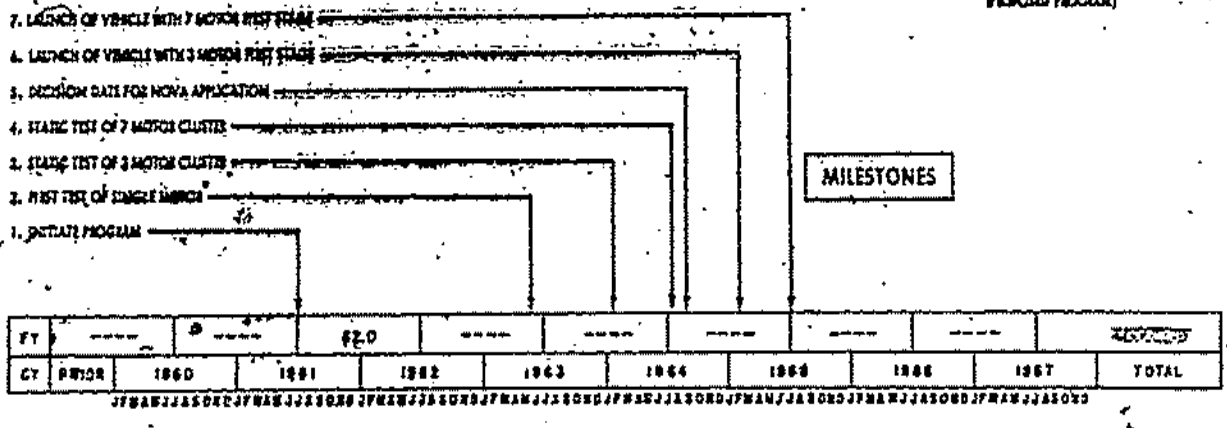
| Position | Condition | Time sec | Altitude N.M. | Range N.M. | Velocity ft/sec | Impact Point |
|---|---|---|---|---|---|---|
| 1 | Launch | | | | | |
| 2 | Stage 1 Burnout | | | | | |
| 3 | Stage 2 Burnout | | | | | |
| 4 | Stage 3 Ignition | | | | | |
| 5 | Stage 3 Burnout | | | | | |

# SOLID PROPELLANT LAUNCH VEHICLES

UNCLASSIFIED
SECRET

PRELIMINARY DEVELOPMENT SCHEDULE

AIR FORCE
(DYNASOAR PROGRAM)




EVENTS

BASIC FACTS

1. The research and development in the field of solid propellants for POLARIS, MINUTEMAN and PERSHING missiles provides the scientific and technological basis for this program.
2. Both government funded and in-house studies of the application of solid propellants for space boosters have been carried on by the industry during FY 60 and FY 61.
3. The schedule indicated above is an estimate which is based on continuing generous support of the program at high priority.
4. Program under review and schedule and funding now being finalized.

SECRET

# SOLID PROPELLANT LAUNCH VEHICLES

AIR FORCE

## VEHICLE CHARACTERISTICS

| Basic Motor | |
|---|---|
| Weight | Approx. 750,000 lbs |
| Thrust | 2 - 3 million lbs |

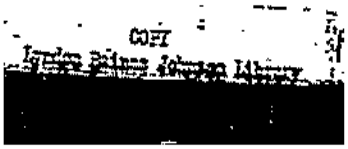
| First Stage for NOVA Vehicle | |
|---|---|
| Cluster of 7 basic motors | |
| Thrust | 14 to 21 million lbs |

| Second Stage for NOVA Vehicle | |
|---|---|
| Cluster of 3 basic motors | |
| Thrust | 6 to 9 million lbs |

A program for the development of a large motor for use in clusters, to form the lower two stages of the NOVA vehicle for manned lunar landings has been initiated. The relatively short time required for development of a solid propulsion motor may become a key factor in accelerating the overall development of this vehicle. The advanced system and component projects will establish, on an experimental basis, the background that will permit exploitation of the high reliability, simplicity, and economy that is inherent in solid propellant engines. Techniques will be developed for improving the utility and versatility of solid propellant rockets by developing advanced methods for vectoring, modulating, and terminating thrust.

Solid propellant rockets have many potential advantages. From a manufacturing and logistic point of view, the following characteristics are significant: (1) even very large solid propellant motors are extremely simple in design, since they contain no complex components nor moving parts; (2) the complete loaded motor or loaded segments can be prepared at the manufacturing plant, and shipped easily and safely by common carriers, with no fueling or special preparations required immediately prior to launch; (3) the propellants are non-toxic, non-corrosive, and non-explosive, and can be made from materials easily available in large quantities and at a low price through basically simple processes; and (4) the assembled motor, or their segments can be stored. As a result of these characteristics, the solid rocket enjoys a relatively low development and manufacturing cost with a high degree of reliability in operation. Of equal importance is the relatively short development time that is required for even a very large solid motor.

In the prototype development area, the objective is to develop a large thrust motor for use in two solid propellant stages for a NOVA class launch vehicle. The method of approach is to develop a basic solid propellant motor, weighing approximately 750-000 lbs, with thrust of approximately 2-3 million pounds, and to subsequently cluster seven motors to form a first stage, and three more of the same motors to form a second stage. These motors and stages will be developed on a time scale leading to an early flight test of the NOVA and will be designed for compatibility with the upper stages and structures of the overall vehicle system. Studies performed previously have indicated that solid motors have several very promising advantages and that there is no basic hinderance to the development of large motor applications. Although, as a second stage, the performance of a solid motor does not approach that of a high energy liquid fueled unit of the same weight, the quick availability and low cost make the solid desirable in the case of NOVA. The performance disadvantage is compensated for by an increase in size of the lower two stages.

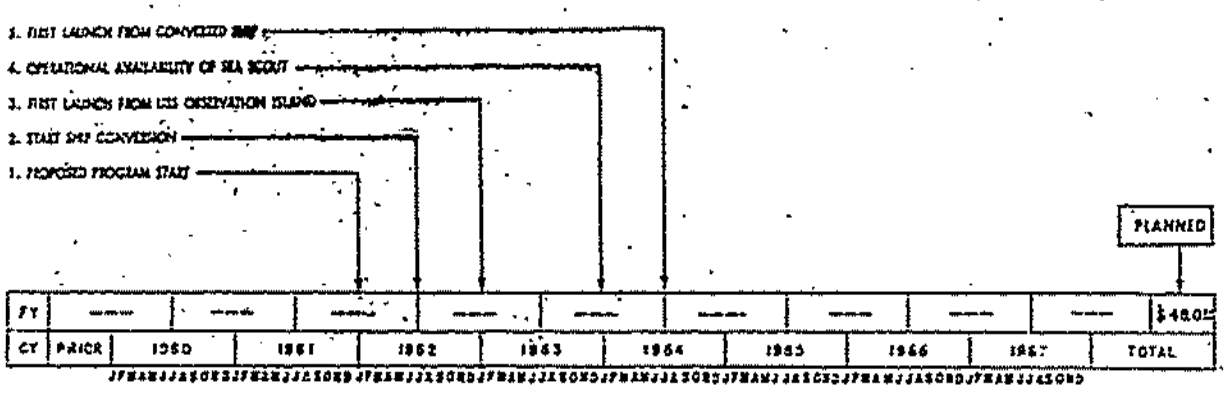


# SEA SCOUT

NAVY

(PROPOSED PROGRAM)

## MILESTONES




## EVENTS

**BASIC FACTS**

1. SEA SCOUT offers a means of placing tactical operational payloads into certain earth orbits with a minimum danger of overfly hostile fallout damage or range restrictions.
2. The development of SEA SCOUT can be accomplished in two years for about 15 million dollars.
3. The conversion of a surplus tanker (AV) to the role of a satellite launch ship can be accomplished in 18 months at a cost of about 15 million dollars.

SECRET

# SEA SCOUT NAVY

(PROPOSED PROGRAM)

## GENERAL VEHICLE DATA

| | |
|---|---|
| Height | 40 ft |
| Max. Diam. | 6.5 ft |
| Gross Wt. | 31,450 lb |
| Thrust (S.L.) | 66,830 lb |

## VEHICLE CHARACTERISTICS

| | 1st | 2nd | 3rd | 4th |
|---|---|---|---|---|
| Lift-off Wt. (Less Payload) | 31,300 | 8,690 | 2,780 | 640 |
| Prop. Wt. | 15,300 | 7,350 | 2,080 | 455 |
| No. of Engines | 1 | 1 | 1 | 1 |
| Total thrust | 66,830 | 30,000 | 18,500 | 5,030 |
| Propellants | Solid | Solid | Solid | Solid |

## MANUFACTURER

| | Stage | | | |
|---|---|---|---|---|
| | 1st | 2nd | 3rd | 4th |
| Vehicle | Lockheed | Lockheed | Chance Vought | Chance Vought |
| Engine | Aerojet | ABL | ABL | ABL |
| Guidance | G.E. | G.E. | Minn. H | Minn. H |

## PERFORMANCE

Using early POLARIS A-1 engines will place 150-lb into a circular 300 mile orbit. Using the projected A-3 version, this may be increased to 450 pounds.

SEA SCOUT is a proposed four stage, solid rocket water space booster, formed by combining the POLARIS missile first and second stages with the NASA SCOUT third and fourth stages. All accessory support equipment has been developed as part of the POLARIS and SCOUT programs and can be adapted for SEA SCOUT use. Advance POLARIS engines under development provide a growth potential for SEA SCOUT.

Use of the POLARIS test ship (USS OBSERVATION ISLAND) has been proposed for ballistic launches. The conversion of a seaplane tender (AV) to the role of a satellite launch ship has also been proposed.

SECRET

# TITAN II

AIR FORCE
PROPOSED PROGRAM

MILESTONES

3. AVAILABILITY FOR OPERATIONAL LAUNCHES
2. FIRST LAUNCH
1. PROPOSED PROGRAM START

PLANNED

| FY | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ISK |
|---|---|---|---|---|---|---|---|---|---|---|
| CY | PRIOR | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | TOTAL |

J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D

EVENTS

**BASIC FACTS**

1. The 15 million dollars will cover the cost of the necessary modifications to the TITAN II, and the purchase of a vehicle and a facility of this configuration.

2. The selection of a suitable spacecraft including the [illegible] for the separation from the second stage of TITAN II must be financed separately.

3. This development is paced by the availability of a TITAN II missile and a launch facility for space purposes. It is possible that this type of development could be made a part of the TITAN III/M research and development launch program. The first launch could take place in early Calendar Year 1963.

SECRET

page 107 sanitized

# TITAN II – AGENA B

AIR FORCE
PROPOSED PROGRAM

## MILESTONES

3. AVAILABILITY FOR OPERATIONAL LAUNCHES
2. FIRST LAUNCH
1. PROPOSED PROGRAM START

PLANNED

| FY | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | $ 38.0M |
|---|---|---|---|---|---|---|---|---|---|---|
| CY | PRIOR | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | TOTAL |

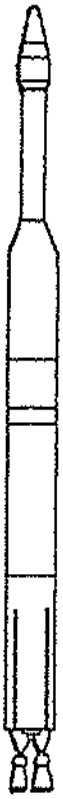
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D

## EVENTS

**BASIC FACTS**

1. The 38 million dollars will cover the cost of necessary modifications to the TITAN II, and the basic AGENA D and the purchase of an additional vehicle as a backstop of this configuration.
2. This configuration would be a possible way to provide for an increase in weight of _____ payloads now limited by the capability of the ATLAS AGENA B vehicle.
3. This development is paced by the availability of a modified launch facility in May 1963.

# TITAN II AGENA B - AIR FORCE



**GENERAL VEHICLE DATA**

| | |
|---|---|
| Height | 128 ft. |
| Max. Diam | 10 ft. |
| Gross Wt. | 253,600 lb. |
| Thrust (S.L.) | 430,000 lb. |

**MANUFACTURER**

| | Stage 1st | Stage 2nd | Stage 3rd |
|---|---|---|---|
| Vehicle | Martin | Martin | Lockheed |
| Engine | Aerojet | Aerojet | Bell A/C |
| Guidance | AC Spark Plug | AC Spark Plug | Lockheed |

**VEHICLE CHARACTERISTICS**

| | | Stage 1st | Stage 2nd | Stage 3rd |
|---|---|---|---|---|
| Lift-off Wt. | (Less pay-load) | 253,600 | 63,000 | 15,800 |
| Prop. Wt. | | 243,600 | 58,000 | 13,200 |
| No. of engines | | 2 | 1 | 1 |
| Total thrust | | 430,000 | 100,000 | 16,000 |
| Fuel | | UDMH-$N_2H_4$ | UDMH-$N_2H_4$ | UDMH |
| Oxidizer | | $N_2O_4$ | $N_2O_4$ | IRFNA |

**PERFORMANCE**

| | | 24 hr Equatorial orbit | Moon & Venus |
|---|---|---|---|
| 300 N.M. orbit 7750 | Escape 1750 | 550 | |

*Modifications to TITAN II are required such as increasing the skin gauge of the forward transition area, strengthening the interface frame, adding an auxiliary pressurization system to the Stage II oxidizer tank and converting some outputs of the guidance computer to provide AGENA with discrete staging signals.*

# TITAN II – CENTAUR

SECRET
Unclassified

AIR FORCE
(PROPOSED PROGRAM)

## MILESTONES

3. AVAILABILITY FOR OPERATIONAL LAUNCHES
2. FIRST LAUNCH, TITAN II CENTAUR
1. PROPOSED PROGRAM START

PLANNED

| FY | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | $500M |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CY | PRIOR | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | TOTAL | |

J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D

## EVENTS

### BASIC FACTS

1. Total time from go ahead to first flight would be 18 months. The earliest date for first flight would be early 1963.
2. The $8 million dollar cost for this includes purchase of 2 modified TITAN II, 2 modified CENTAUR upper stage and the necessary changes in the TITAN launch facilities. This will provide the backup vehicle.
3. This configuration would be suitable for support of the ADVENT program and other missions requiring a greater payload capability than the present ATLAS CENTAUR.
4. The development is paced by the availability of a modified launch facility in May 1963.

SECRET

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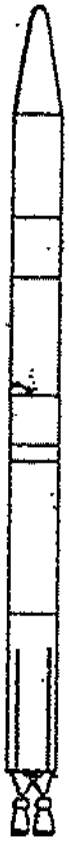
Unclassified

# TITAN II CENTAUR AIR FORCE



## GENERAL VEHICLE DATA

| | |
|---|---|
| Height | 132 ft |
| Max. Diam. | 10 ft |
| Gross Wt. | 348,000 lb |
| Thrust (S.L.) | 430,000 lb |

## MANUFACTURER

| | 1st Stage | 2nd Stage | 3rd Stage |
|---|---|---|---|
| Vehicle | Martin | Martin | Convair |
| Engine | Aerojet | Aerojet | Pratt & Wh. |
| Guidance | AC Spark Plug | AC Spark Plug | Minn. Honeywell |

## VEHICLE CHARACTERISTICS

| | 1st Stage | 2nd Stage | 3rd Stage |
|---|---|---|---|
| Lift-off Wt. (less payload) | 348,000 | 73,000 | 32,000 |
| Prop. Wt. | 243,600 | 58,000 | 27,500 |
| No. of engines | 2 | 1 | 2 |
| Total thrust | | | |
| Fuel | UDMH-$N_2H_4$ | UDMH-$N_2H_4$ | $H_2$ |
| Oxidizer | $N_2O_4$ | $N_2O_4$ | $O_2$ |

## PERFORMANCE

| 300 N.M. orbit | Escape | Equatorial orbit | Mars & Venus |
|---|---|---|---|
| 11,250 lb | 3,150 lb | 1,300 lb | 2,600 lb |

CENTAUR is being developed as an upper stage for the ATLAS D ICBM. The combination with TITAN II yields a significantly increased performance. Minor structural modifications to the TITAN II vehicle are required. For this configuration guidance equipment is mounted in CENTAUR; consequently the inertial guidance system presently in TITAN II can be removed. This vehicle can be launched from existing TITAN research and development stands.

# TITAN II -- Advanced Upper Stage

SECRET
UNCLASSIFIED

AIR FORCE
(PROPOSED PROGRAM)

## MILESTONES

3. AVAILABILITY FOR OPERATIONAL LAUNCHES
2. TITAN II - ADVANCED UPPER STAGE
1. PROPOSED PROGRAM START

PLANNED

| FY | ----- | ----- | | | | | | | | | 150-200M |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CT | PRIOR | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | | TOTAL |

J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D

## EVENTS

### BASIC FACTS

1. The total cost of 150 to 200 million dollars includes the development of the upper stage and the propulsion system, uprating of the TITAN II missile to 500,000 pound thrust, the necessary modifications to the TITAN launch facilities and the purchase of a four vehicle research and development program.

2. The Fluorine-Hydrazine propellant combination which has proposed for this upper stage is predicted to have the capability of long-time storage in space.

3. A total time of two years will be required from go ahead to launch of the first vehicle with this configuration.

SECRET

SECRET
(unclassified)

# TITAN II - ADVANCED UPPER STAGE—AIR FORCE

## GENERAL VEHICLE DATA

| | |
|---|---|
| Height | 125 ft. |
| Max. Diam. | 10 ft. |
| Gross Wt. * | 257,000 lb. |
| Thrust | 500,000 lb. |

*Varies with payload.

## VEHICLE CHARACTERISTICS

| | (Less payload) | Stage 1st | Stage 2nd | Stage 3rd |
|---|---|---|---|---|
| Lift-off Wt. | | 258,000 | 63,000 | 34,000 |
| Prop. Wt. | | 247,000 | 58,000 | 31,400 |
| No. of engines | | 2 | 1 | 1 |
| Total thrust | | 500,000# | 100,000# | 25,000# |
| Fuel | | UDMH $N_2H_4$ | UDMH $N_2H_4$ | $N_2H_4$ |
| Oxidizer | | $N_2O_4$ | $N_2O_4$ | $F_2$ |

## MANUFACTURER

| | Stage | | |
|---|---|---|---|
| Vehicle | Martin | Martin | Not Yet |
| Engine | Aerojet | Aerojet | Selected |
| Guidance | AC Spark Plug | AC Spark Plug | |

## PERFORMANCE

| 300 N.M. orbit | Escape | 24 hr Equatorial orbit | Mars & Venus |
|---|---|---|---|
| 14,000 | 5,000 | 2,900 | 4,200 |
| 14,000 lb. | 5,000 lb. | 2,900 lb. | 4,200 lb. |

The capability for space mission of an upper stage vehicle utilizing fluorine hydrazine propulsion boosted by an uprated TITAN II is large. Although this combination of propellants has never been tried in a space vehicle its characteristics have been the subject of a funded study for the Air Force. The modifications to TITAN II for this application have been determined. It is expected that the first stage propulsion will be uprated to a total thrust of 500,000 pounds. The resulting structural modifications to TITAN II are well within the capability of existing tooling.

SECRET

COPY

## FY 1962 INCREASES IN UNITED STATES SPACE PROGRAM
### Recommended May 25, 1961
( New Obligational Authority - in millions )

| | Agency | Increase |
|---|---|---|
| 1. Related to Manned Lunar Landing Goal | | |
| Spacecraft: | | |
| Apollo | NASA | $130.5 |
| Space Flight Center | NASA | 60.0 |
| Life sciences | NASA | 12.0 |
| Alternate Very Large Boosters: | | |
| Liquid: | | |
| Nova Vehicle | NASA | 49.5 |
| Nova Facilities | NASA | 28.0 |
| F-1 Engine | NASA | 15.0 |
| F-1 Facilities | NASA | 30.0 |
| Solid: | | |
| Boosters | DOD | 50.0 |
| Test Facilities | DOD | 12.0 |
| Other engine development - new upper stage | DOD | 15.0 |
| Unmanned lunar exploration | NASA | 56.0 |
| Supporting Research and other: | | |
| Tracking station | NASA | 5.0 |
| Scientific satellites | NASA | 8.0 |
| Sounding rockets | NASA | 2.0 |
| Launch vehicle technology | | |
| Orbital docking | NASA | 8.0 |
| Other | NASA | 4.0 |
| Salaries and expenses | NASA | 30.0 |
| Support of plant | NASA | 12.0 |
| Advanced facility design | NASA | 5.0 |
| Total related to Manned Lunar Landing | | $531.0 |

| | Agency | Increase |
|---|---|---|
| 2. Rover | | |
| Nuclear systems technology | NASA | 8.0 |
| National Nuclear Rocket Development Facility | NASA | 15.0 |
| Nuclear reactor technology (existing appropriations) | AEC | (7.0) |
| Total Rover | | 23.0 |
| 3. Communications | NASA | 50.0 |
| 4. Meteorology | | |
| Additional TIROS | NASA | 22.0 |
| NIMBUS operational system | WB | 53.0 |
| Total Meteorology | | 75.0 |
| Total additional funds recommended | | 679.0 1/ |

**************

| Recapitulation by Agency | |
|---|---|
| National Aeronautics and Space Administration | 549.0 |
| Department of Defense | |
| Solid booster | 62.0 |
| New upper stage | 15.0 |
| Total | 77.0 |
| Weather Bureau | 53.0 |
| Atomic Energy Commission (existing approp.) | (7.0) |
| Total additional funds recommended | 679.0 1/ |

1/ In addition, $7 mil. increase for ROVER program will be provided within existing AEC appropriations.

# Military Uses of Space: 1946-1991

**Published by:**
Chadwyck-Healey Inc., 1101 King Street, Alexandria, Virginia 22314

Military Uses of Space: 1946-1991 provides a detailed record of the strategic importance of the U.S. military space program from the conceptualization of the uses of space to the present realization of advanced capabilities. Materials were identified, obtained, assembled, and indexed by the National Security Archive, a non-profit, Washington, D.C. based research institute and library. The microfiche collection is accompanied by Military Uses of Space: 1946-1991 Guide and Index.

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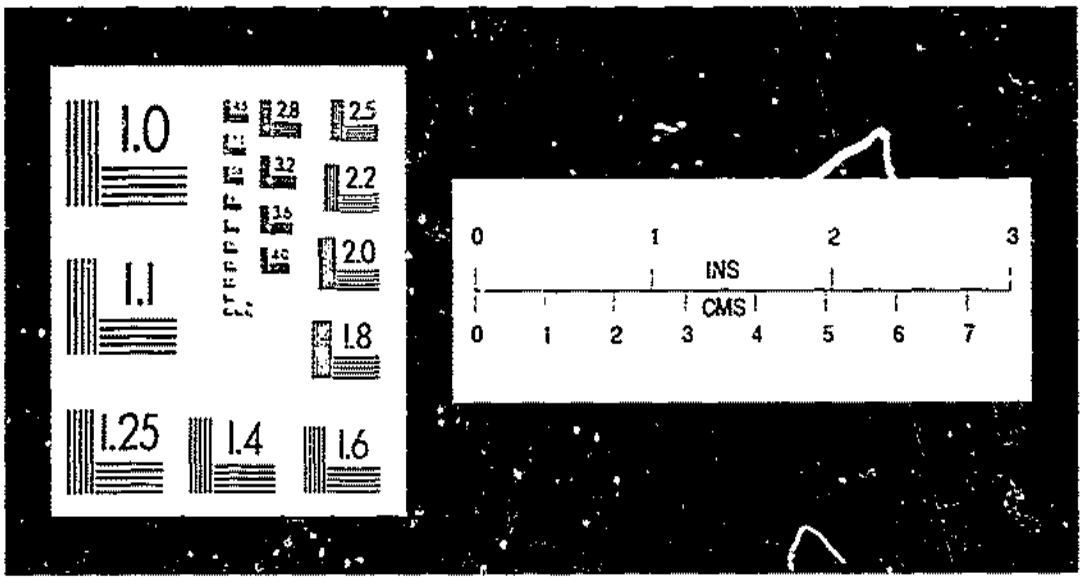
**Technical Data:**
Producing Laboratory: Chadwyck-Healey Inc.
Date of Publication of Microfiche Edition: 1991
Format: 49 frame, 105mm x 148mm silver halide microfiche, 24x nominal reduction



**Distribution Outside the USA:**
Chadwyck-Healey Ltd., Cambridge Place, Cambridge CB2 1NR, England



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## SPACE ACTIVITIES OF THE UNITED STATES GOVERNMENT

( New Obligational Authority/Program Basis - In millions )

Historical Summary and Increases Recommended May 25, 1961

| | NASA 1/ | Defense 2/ | AEC 3/ | NSF 4/ | WB 5/ | Total |
|---|---|---|---|---|---|---|
| 1955 | $ 56.9 | $ 3.0 | - | - | - | $59.9 |
| 1956 | 72.7 | 30.0 | $7.0 | $7.3 | - | 117.3 |
| 1957 | 72.2 | 71.0 | 21.3 | 8.4 | - | 172.9 |
| 1958 | 117.3 | 225.6 | 21.2 | 3.3 | - | 367.5 |
| 1959 | 335.9 | 429.5 | 34.3 | - | - | 582.7 |
| 1960 | 523.6 | 560.9 | 43.3 | .1 | - | 1,139.9 |
| 1961 | 954.0 | 793.7 | 62.7 | .6 | - | 1,779.0 |
| 1962 budget, 1/18/61 | 1,109.6 | 946.9 | 55.1 | 1.6 | $2.2 | 2,065.4 |
| Budget amendments, 3/29/61 | 125.7 | 159.0 | 23.5 | - | - | 308.2 |
| Total present 1962 budget | 1,235.3 | 1,105.9 | 78.6 | 1.6 | 2.2 | 2,323.6 |
| Increases recommended 5/25/61 | 549.0 | 77.0 | 7.0 | - | 53.0 | 686.0 6/ |
| Total 1962 recommendations | 1,784.3 | 1,182.9 | 85.6 | 1.6 | 55.2 | 3,009.6 |

1/ National Aeronautics and Space Administration amounts are totals for all activities of NASA and include totals for NACA prior to establishment of NASA.

2/ Department of Defense amounts are based on identifiable Defense funding for space and space-related effort and do not include substantial amounts for (1) construction and operation of the national missile ranges with regard to space programs, (2) the cost of developing missiles such as Thor and Atlas which are also used in space programs, or (3) supporting research and development (such as bio-medical research) which is more or less mutually applicable to programs other than "space."

3/ Atomic Energy Commission amounts are those identifiable with ROVER nuclear rocket and SNAP atomic power source projects.

4/ National Science Foundation amounts are those identifiable with VANGUARD and with the NSF space telescope project.

5/ Weather Bureau amounts are those identifiable with the meteorological satellite program.

6/ Includes AEC increase of $7 million for ROVER project to be provided within existing AEC appropriations.

INTELLIGENCE ANNEX

SECRET

# INTELLIGENCE ANNEX

## SOVIET SPACE PROGRAM

Introduction

"Since 1955 the announced goal of the Soviet space program has been manned interplanetary travel. Many of the Soviet space activities to date, culminating in the recent manned satellite, have in one way or another contributed to progress toward this eventual goal. While the Soviet space shots have collected scientific data, the scientific aspects of the program seem to have been fairly selected, and to a large degree applicable to the support of future Soviet space missions.

"The Soviet leaders clearly believe that achievements in space enable them to persuade the world that in the realm of science, technology and military strength, the USSR stands in the very front rank of world powers. In seizing an early lead and following it with a series of dramatic successes, they have sought to bolster, both at home and abroad, their claims of the superiority of the Soviet system. The USSR has sought to maximize the impact of its achievement with spectacular 'firsts', often timed to coincide with international political moves. Intervening shots appear to have been designed largely to provide data for these 'firsts'."

These views are stated in the National Intelligence Estimate NIE 11-5-61.

Review of Soviet Space Launches

The early Soviet satellites can be related to three Soviet "space first" objectives:

| | |
|---|---|
| 1. First earth satellite - Sputnik | 4 Oct 57 |
| 2. First biological satellite - Sputnik II | 3 Nov 57 |
| 3. First large geophysical satellite - Sputnik III | 15 May 58 |

The orbited payload (3,000 pounds) of Sputnik III is consistent with that which could be powered into orbit by the ICBM class. It is interesting to note that all of these earth satellites employed the same orbital inclination, as chosen so to coincide with the ICBM test range extending from Tyura Tam to Klyuchi.

The next phase of the Soviet space program was an effort to impact the moon resulting in Lunik II on 12 September 1959. It is significant that no further lunar impact shots have been tried subsequent to this effort. Lunik I, now appears to have been an unsuccessful attempt to impact the moon, but went into a "fail safe" orbit around the sun. Nonetheless, Soviet adaptability in exploiting this event as a space first is noteworthy. The vehicle used for these flights was almost certainly an ICBM boosting the Lunik stage vehicle shown in Figure 1, and the announced payload (970 pounds) for Lunik II is consistent with the mission capability of this combination.

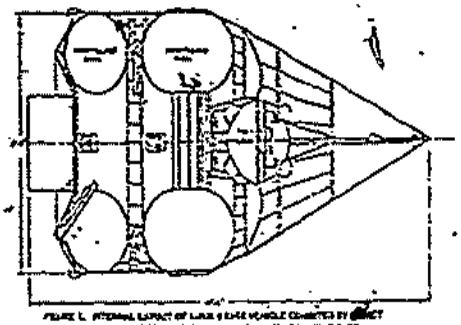

FIGURE 1. INTERNAL LAYOUT OF LUNIK II SPACE VEHICLE EXHIBITED BY SOVIET UNION IN NEW YORK DURING 1959 AND SHOWN AT U.S. 1959 SOVIET SPACE EXHIBIT

SECRET

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Lyndon Baines Johnson Library

One month later the Soviets attempted a more difficult lunar mission with an entirely different type of orbit and successfully sent an oriented photographic payload behind the moon and back to earth. Despite prior probable development of the critical payload on vertical flights at Kapustin Yar, the mission was an extraordinary and probably surprising success -- even to the Russians. The mission used a direct ascent trajectory which again coincided with the ICBM range, but which was a slower (2.5 day) orbit than those used previously (1.5 days) to inspect the moon.

The next major effort in the Soviet space program was the development of recoverable satellite payloads. A large payload cabin (10,300 pounds) was designed to carry out return a man from orbit. This was accomplished with dramatic effect after five development shots, at least three of which successfully returned dogs from orbit. There is no special significance to the launching time for earth satellites (other than provision for morning recovery), although there is ample intelligence information to support the announcements made about these shots. All of these launchings exploited the existing range line within narrow limits. The vehicle used to power the space cabin into orbit is known _____ to have been the familiar ICBM-Lunik stage combination, and the announced payload in orbit is consistent with the capability of this combination. The series of Sputniks IV through XI is significant because it was the first time that a successful space flight was repeated a number of times by the Soviets. The multiple recovery of dogs from space on the first orbit and on the 16th orbit before Major Gagarin's flight undoubtedly represented essential development testing of the life support and recovery system.

A unique celestial opportunity to send the first probes to Mars was presented in the fall of 1960 and for Venus in early 1961, and the Soviet Union accepted the challenge with commitment of major resources. A totally new (40,000 pound) third stage was developed, probably well in advance of the attempts, to stand between the ICBM booster and Lunik stage vehicle, so as to operate their performance to accomplish these more expensive missions. The Soviets also abandoned direct ascent trajectories in favor of the more economical* parking orbit techniques for the first time, in spite of guidance complications.

*In terms of burnout speed or equivalent payload.

On 4 February 1961, the Soviets tried to make Venus and this time the ICBM and new lunar stage worked well and placed a fourth stage rocket vehicle plus payload in orbit. This fourth stage has been identified with some confidence as another new stage. However, the stage failed to ignite and the vehicle in orbit was calmly called Sputnik VII, thereby setting a new payload-in-orbit time record. One week later they returned to the task with the same vehicle. This time all stages operated correctly and the rest is history. The cost in ICBM's and upper stages to do this job was certainly large and fell during the middle of the man-in-space development effort inclusive flexibility, perhaps in launching facilities, and a real determination to make out the Mars and/or Venus claim.

Except for a recognition of progressively more sophisticated payloads on Soviet space shots, this brief summary essentially provides the background for an evaluation of their apparent objectives and program.

Apparent Objectives

The foregoing reconstruction of the Soviet space program represents a standard list of initial space first objectives. There is no tangible evidence of Soviet military or civilian space applications similar to those made by the United States thus far, although they certainly do possess the capability to do so at any time. The criterion of real scientific merit, which is so prominent in our own space decisions, seems to be much less in theirs. While it is true that the early satellites and some later probes carried scientific instruments, there is no evidence of sustained and recurring efforts to study space in a serious systematic way except for the biomedical program leading to the man in space objective.

The Soviet program is characterized by a sequential attack on prominent "adventure first", arranged according to order of increasing difficulty. Total re-

page 123 sanitized

Consistent use of this vehicle for both space and ICBM firings has undoubtedly benefited from the "developed reliability" of the basic vehicle gained in the large number of tests. One can argue that the Soviet space program benefited from the inability of the Soviet rocket development program to produce light warheads, which in turn resulted in the larger basic booster, and this is almost certainly correct. In any case, the consistent and exclusive use of the vehicle and its very major launching and support facilities at Tyura Tam has certainly reduced the total incremental cost of the Soviet space program.

The important point with respect to rocket vehicles is the way in which a small number of upper stage vehicles were designed and exploited to accomplish the initial Soviet space objectives. Based on the post-flight analysis described earlier, only four distinct vehicle combinations have been used in the Soviet space program to date, and these are shown in Figure 2. The early Sputnik satellites were probably two stage boosters flown into orbit with Sputnik III representing something close to the orbital payload capability of the standard ICBM. The approximate layouts of Figure 2 show the Soviet ICBM as a partial or one-and-a-half stage configuration. It is also quite possible that the ICBM has a parallel configuration, although the performance capability is essentially independent of configuration to a first approximation.

The high speed, direct escape shots of the moon used the second combination shown in Figure 2, with the multiple purpose Lunik stage shown in Figure 1 with a 1,000-pound payload mounted directly on the ICBM. This 18,000-pound stage is close to optimum size and thrust for performing these high speed (37,000 ft/sec) lunar missions with the ICBM.

The same stage appears in the recoverable satellite or man-in-space shots as a standard lunar stage providing the additional impulse over that of the ICBM to power the heavy Soviet space cabin into low-altitude orbit. Again, the performance combination is quite good for the payload range required. Successful development of an attitude-in-orbit control system for the Lunik stage and/or recoverable cabin represented a major step forward.

Two new upper stages probably were used in the high speed coasting orbits to Mars and Venus. It seems probable that this combination is close as far as any one can go in stacking stages on top of the Soviet ICBM, since there is [redacted] thrust shutting on these shots before booster staging, presumably to avoid intolerable structural loads. With the exception of terminal (perhaps solid) retrorockets which may be added for multiple thrust period missions (i.e., 24-hour satellite, soft lunar landing, etc.), Figure 2 represents the basic booster family for the near term. There is still a great deal of "mission mileage" in this family.

The earliest known availability dates of the ICBM booster, Lunik stage, recovery capsule, and heavy inner stage are also indicated in Figure 2. When one considers that the Lunik stage was probably started in 1956 one begins to appreciate the breadth of decisions and objectives which must have been available to the responsible parties. The subsequent appearance of the more complex attitude stabilized recoverable space cabin and heavy inner stage indicates that joint decisions for these missions and vehicle combinations were probably not far behind that of the Lunik stage in 1955.

The extent of this preplanning and integrated design program is further emphasized by the consistent use of a very narrow firing azimuth for all Soviet space and ICBM shots fired to date. This range conformance has probably not cost a significant amount of performance, and has tended to amortize the very heavy investment [redacted] over a large number of shots. It is interesting that the Soviets have accomplished rather skillful tracking and communication with all of their vehicles, despite serious geographic restrictions which have precluded a Soviet series of world-wide ground tracking stations — at least to date. One cannot help but feel that the favorable visibility conditions for all space shots from Soviet territory is a result of careful range planning and stringent controls on the launching schedules.

There is evidence of continued strong Soviet interest in their manned recoverable satellite program. The utility of this vehicle will probably increase over the next few years as it acquires more sophisticated flight characteristics.

There is also evidence [redacted] equivalent in size to the U. S. Saturn facility at Huntsville, Alabama, that the Soviets are now developing a liquid rocket engine with a thrust of some one to two and a half million pounds which could be available in about 1963.

Forecast Analysis

A prediction of future Soviet space events is, at best, an educated projection based upon an analysis of past events correlated with public announcements by prominent Soviet spokesmen and with intelligence information relating to technical capabilities. The projection is not based upon known Soviet plans, of course. However, a definite pattern is evident from past correlation, and USSR objectives are, in broad terms, quite apparent. Past predictions, based upon the same techniques, in retrospect, have been quite accurate.

In October 1951, M. K. Tikhonravov stated that space flight and the creation of artificial earth satellites were entirely feasible, publicly indicating for the first time serious Soviet interest in the development of a space program. By 1954, statements had been made not only concerning the feasibility of earth satellites, but of lunar probes and interplanetary vehicles. These projected ideas were boosted into official goals with the creation in 1954 of the ICIC, which was charged with assisting the "..... development of scientific - theoretical and practical work in the Soviet Union concerning questions of studying cosmic space and the achievement of interplanetary communications." Any doubts as to the meaning of the generic phrase "interplanetary communications" was dispelled with later commentaries by responsible Soviet scientists, perhaps the strongest of which was that "the ultimate aim of all rocket launching, of all exploration of the upper regions of the atmosphere, stratosphere and interplanetary space is to have humans travel safely from one point to another at some future time ....."

From the time of the official establishment of the ICIC, it has been apparent that the general content of all statements concerning the Soviet space program has been carefully coordinated and controlled at the highest levels of Government. This has enabled Moscow's propagandists to deceptively utilize space vehicles and their capability for the scientific exploration of space as a major weapon in the cold war. Their consistent theme has been that the Soviets are ahead of the U. S. in the exploration of space — so far ahead that the U. S. can't possibly catch up. Successes in space operations have been generalized to include all aspects of science and technology, thereby reflecting the superiority, vitality, and perfection of the Socialist system. The Soviets have represented each successive launching as a major technological step forward, which in fact some have been, and to maximize the credibility of their claims, have relied to a large extent on statements by leading Soviet scientists. Released information is made carefully imprecise concerning launching hardware, vehicle design, project time scales and priorities. Yet it has been found, however, that emphasis on a particular type of exploit in propaganda media has generally been followed by a shot of appropriate nature. Although vague, and outwardly tending to emphasize the magnitude of Soviet achievements, an analysis of these statements made over the past ten years shows that the USSR has released a fairly general but consistent picture of their space program to date. No single propaganda medium or personality has been a "best" source of information although the preponderance of statements have come from Radio Moscow. Such statements can be categorized as post facto commentaries claiming a particular or general capability or predictive statements. A minor portion of a selected list of predictive statements made by Soviet scientists is shown for illustrative purposes and should be used in conjunction with the Russian chronology shown in Table I.

Table I. Russian Chronology of Space Launches

| Date | | Payload Wt (lbs) | Remarks |
|---|---|---|---|
| Oct 4, 1957 | Sputnik I | 184 | 1st earth satellite |
| Nov 3, 1957 | Sputnik II | 1,120 | 1st biomedical satellite (dog - Laika) |
| May 15, 1958 | Sputnik III | 2,925 | 1st large geophysical satellite |
| Jan 2, 1959 | Lunik I | 797 | 1st lunar probe fly by, now in solar orbit |
| Sept 12, 1959 | Lunik II | 858 | 1st lunar impact |

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[redacted]

[redacted]

[redacted]

25,000 pounds in orbit is estimated to be 1962.

Estimate

Military or utility satellites - 1961.

Evidence

Soviet press and radio reflect an increasing interest in the use of satellites for weather observation. A recent statement says that plans are afoot for a satellite spaceship equipped with radar for precipitation and cloud observation. They also state that a spaceship equipped with TV for day operation and thermal-detectors by night would be useful for weather observations. It may be significant to note that the Soviets have used the term "spaceship" only with reference to the 10,000 pound vehicle for the man-in-space event. An estimate of the configuration of this vehicle indicates that equipment could be relatively easily installed in the 10,000 pound vehicle which would be suitable for weather or surface reconnaissance purposes. It is entirely possible that this spaceship will be improved and used for a variety of orbiting observational purposes, both manned and unmanned. It is expected that the experience gained in surface photography and TV relay in Lunik III (October 1959) will be utilized at an early date in an earth satellite vehicle.

Estimate

Unmanned lunar satellite and soft landing, 1961.

Evidence

Logical and necessary steps in the exploration of the moon are the establishment of a lunar satellite followed by a soft landing or one sufficiently soft so that an instrument package may reach the moon's surface intact. It takes a velocity of about 35,000 feet per second to escape the earth and reach the region of the moon, then about 4,000 feet per second reverse thrust are required to reduce speed to lunar low orbit speed and about another 4,800 feet per second to to reduce speed still further to descend to the lunar surface.

A total velocity requirement of 39,000 feet per second is required to orbit the moon. The Soviets can place a payload on the order of 2,000 pounds in a lunar orbit using their Venus Probe launch system. The last propulsion stage used for the Venus Probe would have to be restartable or replaced by two new stages. The control of injection parameters from a parking orbit is probably not good enough at present to attain the correct orbital altitude above the moon's surface. However, a small amount of mid-course correction, 150 feet per second, would be sufficient and Soviet [redacted] payload capability are probably adequate for the solution of this problem in the near future.

A soft landing on the moon requires approximately 44,000 feet per second total velocity and is not achievable using known Soviet staging. Nevertheless, Soviet desire to achieve spectacular firsts probably will result in seeking relatively simple ways for the Soviets to make a non-destructive landing of an instrumented package on the moon. Such a device could radio back to earth information on the nature of the moon's surface, continents, magnetic, gravitational, seismic and radiation data of great value to future lunar exploration.

Calculations show that the addition of a solid final stage to the Lunik vehicle is one way to soft or "rough" land a very low payload, on the order of 150 pounds, on the moon's surface. The addition of a solid stage to the Venus probe vehicle probably could permit soft landing of about 500 pounds. There is still no evidence to indicate the Soviet attack on this problem. However, the two lunar vehicle failures of April 1960, the previous lunar successes, and the Soviet penchant for moving on to the next challenge gives credence to the belief that they were trying more advanced lunar tests with the Lunik vehicle, possibly with a new final stage. Since there have been no lunar shot attempts since April 1960, it is possible that the Soviets have discarded the Lunik stage in favor of more promising payload capability with the new upper stages of the Venus vehicle.

The use of high energy propellants in the upper stages of the Venus vehicle could permit a payload of a few thousand pounds to be soft landed on the moon in the next two or three years.

Estimate

A new Soviet rocket engine, a single chamber of which will have one to two and a half million pounds of thrust.

First flight, single chamber 1962.

Clustered version operational in 1965.

Payload capability of clustered version 50 to 100 tons.

Evidence

[redacted] Based on the size of the test stand and the liquid fuel storage facility, it is estimated that this test stand has been developed to allow for the testing of engines of one to two and one-half million pounds thrust.

[redacted] In contrast with present program status and estimated intention, it is probable that large single chamber will be tested here. Based on the status of this project in December 1959, the estimated date of completion of the facility is mid-1961. Two years is allowed for the single chamber flight test and an additional five years for the clustered version to reach operational status.

Estimate

Lunar landing and exploration (Tentative) 1965.

Evidence

This vehicle was selected for special interpretation because of the extensive coverage it has been given in the Soviet press and because of the propaganda impact achievable from such a device. The estimated size of this vehicle probably will require a multi-million pound thrust booster. For this reason, the estimate of earliest availability in 1965 depends primarily on the new large booster estimate. It is believed the other problems in guidance, communications, and propulsion necessary to this event will be solved prior to 1965 in accordance with estimates on lunar satellites and soft landings.

Estimate

Manned glide-type vehicle recovery from earth orbit - 1963

Background

There is no direct evidence of Soviet effort to develop glide-type vehicles. It is believed the present 10,000 pound man-in-space vehicle is a ballistic vehicle and that its life support re-entry and recovery systems are related closely to developments used in their vertical rocket program. It is possible that the Soviets could modify the shape of the re-entry heat shield and/or by differential operation of what appear to be segmented braking flaps used presently to slow up re-entry speed, they could produce a small amount of lift to alter the terminal trajectory. Thus, they could claim a glide-type re-entry earlier than 1963. However, the estimate is intended to refer to a glide-type vehicle with a substantial maneuvering capability.

At the present time the X-15 program is providing data for the development of a manned lifting re-entry vehicle. There is as yet no intelligence to indicate similar Soviet flight testing of lifting re-entry vehicles.

Due to the magnitude of the heating and structural problems for the vehicle, it is estimated that at least two more years from the present would be required for the Soviets to fly it. This vehicle would be initially capable of re-entering from speeds of approximately 26,000 feet per second, low altitude orbit speed. Estimated booster limitations probably will prevent the attainment of significantly higher re-entry velocity in 1963 with such a vehicle.

Estimate

Manned earth orbiting maneuverable flight, 1963, and orbital rendezvous, 1965.

Evidence

The Soviets have already demonstrated a capability to start an engine in orbit and to change the orbital characteristics a single time. The 1963 engine

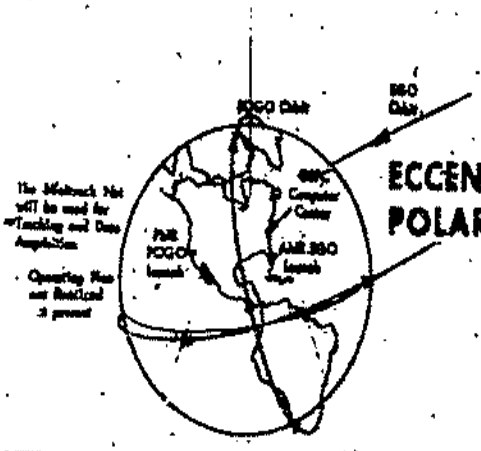
page 132 - 133 sanitised

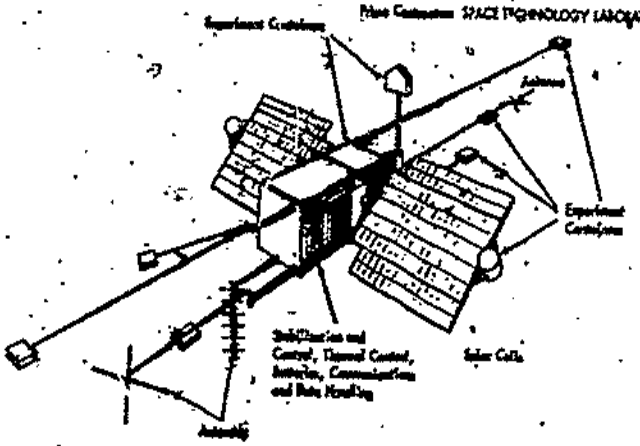
# ORBITING GEOPHYSICAL OBSERVATORY

## ECCENTRIC ORBITING GEOPHYSICAL OBSERVATORY (EGO)
## POLAR ORBITING GEOPGHYSICAL OBSERVATORY (POGO)

NASA

Prime Contractor: SPACE TECHNOLOGY LABORATORIES, INC.




CONFIGURATION OF GEOPHYSICAL OBSERVATORY

| SATELLITE | EGO | POGO |
|---|---|---|
| Weight | | |
| Payload | | 500 lb. |
| Future | | 1000 lb. |
| Orbit | | |
| Perigee | 150 N.M. | 140 N.M. |
| Apogee | 60,000 N.M. | 880 N.M. |
| Inclination | 31° | 90° to 95° |
| Power Source | Solar Cells and Storage Batteries | |
| Stability and Control System | Earth stabilized, momentum biased, and gas jets used Redgyro generation | |
| Propulsion System | Altair-Agena B | Thor-Agena B |
| Signals | | |
| Wide Band Telemetry | Two PCM/FM 400 mw/4 R.F. Transmitters | |
| Narrow Band Telemetry | One PCM/FM/PM 400 mw/4 R.F. Transmitter | |
| Special Purpose Telemetry | One PM/PM 400 mw/4 R.F. Transmitter | |
| Command System | Two PCM/FM/AM command receivers and quadrature | |
| Tracking System | 136 mc/s Beacons | |

| GROUND SYSTEM | EGO | POGO |
|---|---|---|
| Tracking and Data Acquisition System | Minitrack Net | |
| Computer and Data Reduction | NASA-GSFC | |
| Launch Site | AMR | PMR |

**DATA**

The following types of experiments are currently planned: magnetic field, cosmic particles, dust, atmospheric structure, ionosphere, solar physics, astronomy, meteorology, planetary tests, technological, biological and others.